Auckland Council
Te Kaunihera o Tāmaki Makaurau

I hereby give notice that a hearing by commissioners will be held on:

Date:	**Monday 13 to Thursday 16 November 2023** **Monday 20 to Thursday 23 November 2023**
Time:	**9:30am** (unless specified otherwise)
Meeting room:	**Warkworth Town Hall**
Venue:	**2 Alnwick Street, Warkworth**

NOTIFICATION MATERIAL

VOLUME 3

8 NOTICES OF REQUIREMENT FOR THE WARKWORTH PROJECT

TE TUPU NGĀTAHI SUPPORTING GROWTH (AUCKLAND TRANSPORT & WAKA KOTAHI NZ TRANSPORT AGENCY)

COMMISSIONERS

Chairperson	**Richard Blakey**
Commissioners	**Mark Farnsworth**
	Vaughan Smith

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Note: The reports contained within this agenda are for consideration and should not be construed as a decision of Council. Should Commissioners require further information relating to any reports, please contact the Team Leader Hearings.

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ASSESSMENT OF ARBORICULTURAL EFFECTS

TE TUPU NGĀTAHI
SUPPORTING GROWTH

Warkworth Assessment of Arboricultural Effects

May 2023

Version 1.0

Document Status

Responsibility	Name
Author	Matthew Paul
Reviewer	Simon Titter, Matthew Paul
Approver	Simon Titter

Revision Status

Version	Date	Reason for issue
1.0	12/05/2023	Final for lodgement

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Appendix A: Tree Information

Glossary of Defined Terms and Acronyms

Acronym/Term	Description
AEE	Assessment of Effects on the Environment report
AT	Auckland Transport
ATAP	Auckland Transport Alignment Project
ATCOP	AT Code of Practice
AUP:OP	Auckland Unitary Plan: Operative in Part
CEDF	Cultural and Environmental Design Framework
CEMP	Construction Environmental Management Plan
CHI	Cultural Heritage Inventory
CIA	Cultural Impact Assessment
CLMP	Contaminated Land Management Plan
CNVMP	Construction Noise and Vibration Monitoring Plan
CoPTTM	Code of Practice for Temporary Traffic Management
CPTED	Crime Prevention through Environmental Design
CTMP	Construction Traffic Management Plan
DBC	Detailed Business Case
DEB	Decanting Earth Bunds
DSI	Detailed Site Investigation
ECR	Auckland Council Environmental Compensation Ratio
EIANZ	Ecological Impact Assessment New Zealand: terrestrial and freshwater ecosystems
EPA	Environmental Protection Authority
ESCP	Erosion and Sediment Control Plan
FESCP	Final Erosion and Sediment Control Plan
FULSS	Future Urban Land Supply Strategy
FUZ	Future Urban Zone
GHG	Greenhouse Gas emissions
GPS	Government Policy Statement
HNZPT / Heritage NZ	Heritage New Zealand Pouhere Taonga

Acronym/Term	Description
IBC	Indicative Business Case
LGA	Local Government (Auckland Council) Act 2009
MCA	Multi-Criteria Assessment
MHUD	Ministry of Housing and Urban Development
N/A	Not Applicable
NES	National Environmental Standard
NES:FW	Resource Management (National Environmental Standards for Freshwater) Regulations 2020
NPS	National Policy Statement
NPS:FM	National Policy Statement on Freshwater Management
NPS:UD	National Policy Statement on Urban Development
NLTF	National Land Transport Fund
NLTP	National Land Transport Programme
NOR	Notice of Requirement
NOR 1	Northern Public Transport Hub + Park and Ride and Western Link North
NOR 2	Woodcocks Road Upgrade (Western Section)
NOR 3	State Highway 1 Upgrade – South
NOR 4	Matakana Road Upgrade
NOR 5	Sandspit Road Upgrade
NOR 6	Western Link South
NOR 7	Sandspit Link
NOR 8	Wider Western Link (Northern Section)
NZ	New Zealand
NZUP	New Zealand Upgrade Programme
ONF	Outstanding Natural Features
ONL	Outstanding Natural Landscapes
PBC	Programme Business Case
PSI	Preliminary Site Investigation
RCA	Road Controlling Authority

Acronym/Term	Description
RLTP	Auckland Regional Land Transport Plan
RMA	Resource Management Act 1991
SEA	Significant Ecological Area
SEV	Stream Ecological Valuation
SH1	State Highway 1
SMAF	Stormwater Management Area: Flow
SQEP	Suitably Qualified and Experienced Practitioner
SL	Sandspit Link
Te Tupu Ngātahi	Te Tupu Ngātahi Supporting Growth Alliance
UDEF	Urban Design Evaluation and Framework
ULDMP	Urban Landscape and Design Management Plan
Watercare	Watercare Services Limited
Waka Kotahi	Waka Kotahi New Zealand Transport Agency
WL	Western Link
Zero Carbon Act	Climate Change Response (Zero Carbon) Amendment Act 2018

Executive Summary

Overview

The Warkworth Assessment Package is a network of planned transport infrastructure with the purpose of responding to planned future growth in the Warkworth growth areas. The transport network is made of eight NoRs including new corridors, existing road upgrades, and a public transport interchange with park and ride.

Table 1. Warkworth Assessment Package – NoR and Project Overview

Notice	Project
NOR 1	**Northern Public Transport Hub and Western Link - North**
NOR 2	**Woodcocks Road Upgrade (Western Section)**
NOR 3	**State Highway 1 Upgrade – South**
NOR 4	**Matakana Road Upgrade**
NOR 5	**Sandspit Road Upgrade**
NOR 6	**Western Link - South**
NOR 7	**Sandspit Link**
NOR 8	**Wider Western Link – North**

Methodology

This Report has been prepared following site visits that were undertaken for the collection of suitable data to inform an Assessment of Arboricultural Effects of the Warkworth project (the **Project**). The site visits and desktop review involved recording details of all relevant trees (as described further in this Report) within the Notices of Requirement (**NORs**).

Trees were recorded singularly, or in groups where logical groupings could be made based on species, configuration and/or size. Sufficient information was gathered to allow an assessment of the existing environment and consideration of the future environment. Tree details are presented in table and in GIS mapping formats (contained in the Appendices of this Report).

The existing environment for the majority of the Project corridor is primarily rural, the exception being the residential zoned land on Matakana Road and the existing more intensified urban land uses adjacent to SH1. Tree cover associated with the existing urbanised area typically include plantings of amenity trees and riparian vegetation.

The future environment is likely to change over the next 10 – 25 years as intensification occurs along the corridor as a result of recent changes in national policy direction and changes to the Resource Management Act 1991 (**RMA**). This will likely result in a reduction of trees adjoining the corridors, on business and residentially zoned land, which are not afforded any protection in the Auckland Unitary Plan: Operative in part (**AUP:OP**).

A summary of the trees or vegetation requiring removal for each NoR where relevant is provided in the table below with future discussion of the affected vegetation outlined in Sections 5 to 8 of this Report:

NoR	Number of Protected Trees/ Requiring Removal	Mass planted areas/groups of protected vegetation requiring removal
NOR 1	0	0
NOR 2	0	2
NOR 3	0	0
NoR 4	5	2
NOR 5	0	1
NOR 6	0	0
NOR 7	0	0
NOR 8	0	0
Total	**5**	**21**

Given that the Project is to be delivered in 10 – 30 years' time, a tree and vegetation assessment at the time of implementation is recommended to ensure the current conditions are still relevant. Any future tree removal, tree planting or mass planted vegetation should be assessed at that time, with this Report intended to provide a baseline survey.

Mitigation measures commensurate with the anticipated effects on the environment from impacts on protected trees have been considered, with the aim of avoiding, remedying and mitigating effects on trees. It is recommended that a Tree Management Plan (**TMP**) be developed where construction work impacts on trees and groups of trees that are protected under the District Plan provisions (trees protected under Regional Plan provisions will be addressed as part of a future regional resource consent process). Replacement planting protocols are proposed to be developed further as part of the TMP where protected trees are to be removed.

Opportunities for replanting within the berms of the proposed cross section provides the potential for significant mitigation of effects arising from tree removal associated with the Project. The long-term outcome of comprehensive street tree planting will be more trees in the public realm and increased amenity value within the public transport corridor.

Overall, the effects on trees protected by the District Plan will be mitigated by replacement planting within the corridor and on adjacent land.

Summary of Assessment of Effects and Recommendations

Effect	Assessment	Recommendation
Construction		
Removal of trees to enable the Project	A total of 5 individual trees and 21 tree groups are potentially required to be removed as part of the Project. Confirmation as to whether all trees or groups of trees will require removal will be determined as part of the detailed design phase.	As part of the TMP a verification assessment at the time of implementation is recommended to ensure the current conditions are still relevant. Any future tree removal, tree planting or mass planted vegetation should be added and/or assessed at that time, with this Report intended to provide a baseline survey. Given this, it is recommended that a TMP be prepared. A tree transplant assessment is recommended for any trees considered worthy or relocation as part of the Project.
Effects on retained vegetation	Works are proposed within the protected root zones of retained vegetation at the edge of the corridor.	It is recommended that a TMP be prepared prior to construction to address future tree removals, plantings and growth of areas of vegetation beyond the scope of this Report.
Replacement of trees lost in order to construct the Project	Replacement planting is recommended at a minimum of 2:1 for removed trees and a minimum of like for like (in m^2) of mass vegetation will require replanting	A detailed landscape plan with replacement planting at a minimum ratio of 2:1 is to be prepared as part of the Urban Landscape Design Management Plan (**ULDMP**) and detailed design. It is recommended that arboricultural input be sought at the detailed design phase. The specific tree locations and/or tree species are to be reviewed and input provided in order to achieve the best outcome from a long term perspective.
Operation		
Tree trimming or alteration	Replacement trees may require maintenance to retain sight lines and the overhead and lateral clearances of general traffic lanes and the high quality walking and cycling facilities	New street trees or mass planted vegetation (trees specifically) are planted no closer to the future general traffic lanes than 1 m.

1 Introduction

1.1 Purpose and scope of this Report

This Assessment of Arboricultural Effects report (**Report**) has been prepared to inform the Assessment of Effects on the Environment (**AEE**) for eight (8) Notices of Requirement (**NoR**) being sought by Waka Kotahi NZ Transport Agency (**Waka Kotahi**) and Auckland Transport (**AT**) for the Warkworth project (the **Project**) under the Resource Management Act 1991 (**RMA**). Specifically, this Report considers the actual and potential effects associated with the construction and operation of the Project on the existing and likely future environment as it relates to arboricultural effects and recommends measures that may be implemented to avoid, remedy and/or mitigate these effects.

This Report should be read alongside the AEE, which contains further details on the history and context of the Project. The AEE also contains a detailed description of works to be authorised within each NOR, and the typical construction methodologies that will be used to implement this work. These have been reviewed by the author of this report and have been considered as part of this assessment of arboricultural effects. As such, they are not repeated here. Where a description of an activity is necessary to understand the potential effects, it has been included in this Report for clarity

1.2 Report structure

In order to provide a clear assessment of each NOR, this Report follows the structure set out in the AEE. That is, each notice has been separated out into its own section, and each section contains an assessment of the actual and potential effects for the specific NOR. Where appropriate, measures to avoid, remedy or mitigate effects are recommended.

Each section is arranged, starting from the easternmost point of the proposed NOR, to the westernmost point. Table 1 below describes the extent of each section, and where the description of effects can be found in this Report.

Table 2 Report Structure

Sections	Section number
Description of the Project	3
Overview of the methodology used to undertake the assessment and identification of the assessment criteria and any relevant standards or guidelines	4
Identification and description of the existing and likely receiving arboricultural environment;	5.2, 6.1.2, 6.2.2, 6.3.2, 7.2 and 8.2
Assessment of general arboricultural matters for all NORs	5
Assessment of specific arboricultural matters for NOR 1	5
Assessment of specific arboricultural matters for NOR 2	6

Sections	Section number
Assessment of specific arboricultural matters for NOR 3	7
Assessment of specific arboricultural matters for NOR 4	8
Assessment of specific arboricultural matters for NOR 5	9
Assessment of specific arboricultural matters for NOR 6	10
Assessment of specific arboricultural matters for NOR 7	11
Assessment of specific arboricultural matters for NOR 8	12

2 Introduction

This arboricultural assessment has been prepared for the Te Tupu Ngātahi Supporting Growth Alliance, Warkworth Package of Notices of Requirement (NORs) for Auckland Transport (AT) and Waka Kotahi NZ Transport Agency (WK) as requiring authorities under the Resource Management Act 1991 (RMA). The notices are to designate land for future strategic transport corridors as part of Te Tupu Ngātahi Supporting Growth Alliance to enable the future construction, operation and maintenance of transport infrastructure in the Warkworth area of Auckland.

2.1 Warkworth Growth Area

Warkworth is located at the northernmost extent of the Auckland Region, approximately 60km from the Auckland city centre, and 30km north of Orewa. It is identified as a satellite town in the Auckland Unitary Plan: Operative in Part (AUP:OP) and will act as a rural node that serves both the surrounding rural communities as well as connecting to urban Auckland.

The Warkworth growth area will be less than 5km north-south and east-west and will make a significant contribution to the future growth of Auckland's population. A 1000ha of currently rural land has been rezoned (Future Urban Zone) to support significant business and residential growth. At full build out it is anticipated to provide for approximately 8,200 new dwellings and employment activities that will contribute to 4,600 new jobs across Warkworth. This growth area will be development ready in the stages outlined below:

- **Stage 1** Warkworth North – Business land is already live zoned and remainder to be development ready by 2022.
- **Stage 2** Warkworth South – To be development ready between 2028 – 2032
- **Stage 3** Warkworth Northeast – To be development ready between 2033 – 2037

Furthermore, the Warkworth Structure Plan was adopted by the Council in 2019 and sets out the framework for transforming Warkworth from a rural environment to an urbanised community over the next 15 - 20 years.

The Warkworth Assessment Package will provide route protection for the local arterials, which include walking, cycling and public transport linkages needed to support the expected growth in Warkworth. The Warkworth Package of projects is summarised in Section 2.

This report addresses the arboricultural effects of the Warkworth Package (NOR 1 - NOR 8) identified in Table 1 in section 2.

Refer to the Assessment of Effects on the Environment (AEE) for a more detailed project description.

2.2 Purpose and scope of this Report

This arboricultural assessment forms part of the suite of technical reports prepared to support the assessment of effects (AEE) for the Warkworth Package. Its purpose is to inform the AEE that accompanies the eight Warkworth Network NORs sought by AT).

This report considers the actual and potential effects associated with the construction, operation and maintenance of the Warkworth Package on the existing and likely future environment as it relates to

arboricultural effects and recommends measures that may be implemented to avoid, remedy and/or mitigate these effects.

The key matters addressed in this report are as follows:

a) Identify and describe the arboricultural context of the Warkworth Assessment Package area;
b) Identify and describe the actual and potential arboricultural effects of each NOR within the Warkworth Assessment Package;
c) Recommend measures as appropriate to avoid, remedy or mitigate actual and potential arboricultural effects (including any conditions/management plan required) for each Project corridor within the Warkworth Assessment Package; and
d) Present an overall conclusion of the level of actual and potential effects for each Project corridor within the Warkworth Assessment Package after recommended measures are implemented.

This report should be read alongside the AEE, which contains further details on the history and context of the Warkworth project. The AEE also contains a detailed description of works to be authorised within each NOR, and the typical construction methodologies that will be used to implement this work. These have been reviewed by the author of this report and have been considered as part of this assessment of arboricultural effects. As such, they are not repeated here. Where a description of an activity is necessary to understand the potential effects, it has been included in this report for clarity.

3 Warkworth Package Overview

The Warkworth package is a network of planned transport infrastructure with the purpose of responding to planned future growth in the Warkworth growth areas. The transport network is made of eight NORs including public transport interchange, existing road upgrades, and new corridors.

An overview of the Warkworth NOR package is set out in Table 3 and shown in Figure.

Table 3. Warkworth NOR Package

Corridor	NOR	Description	Requiring Authority
Northern Public Transport Hub and Western Link – North	1	New northern public transport hub and associated facilities including a park and ride at the corner of State Highway 1 (SH1) and the new Western Link – North. New urban arterial cross-section with active mode facilities between the intersection of SH1 and Te Honohono ki Tai (Matakana Link Road) to the proposed bridge crossing, enabling a connection for development in the Warkworth Northern Precinct as provided for in the Warkworth North Precinct.	Auckland Transport
Woodcocks Road - West	2	Upgrade of the existing Woodcocks Road corridor between Mansel Drive and Ara Tūhono (Puhoi to Warkworth) to an urban arterial cross-section with active mode facilities.	Auckland Transport

Corridor	NOR	Description	Requiring Authority
State Highway 1 – South Upgrade	3	Upgrade of the existing SH1 corridor between Fairwater Road and the southern Rural Urban Boundary to an urban arterial cross-section with active mode facilities.	Auckland Transport
Matakana Road Upgrade	4	Upgrade of the existing Matakana Road corridor between the Hill Street intersection and the northern Rural Urban Boundary to an urban arterial cross-section with active mode facilities.	Auckland Transport
Sandspit Road Upgrade	5	Upgrade of the existing Sandspit Road corridor between the Hill Street intersection and the eastern Rural Urban Boundary to an urban arterial cross-section with active mode facilities.	Auckland Transport
Western Link – South	6	New urban arterial cross-section with active mode facilities between the intersection of SH1 and McKinney Road and Evelyn Street.	Auckland Transport
Sandspit Link	7	New urban arterial cross-section with active mode facilities between the intersection of Matakana Road and Te Honohono ki Tai (Matakana Link Road) and Sandspit Road.	Auckland Transport
Wider Western Link – North	8	New urban arterial cross-section with active mode facilities between Woodcocks Road and the Mahurangi River.	Auckland Transport

Figure 1. Warkworth NOR package Overview

4 Assessment methodology and statutory context

4.1 Preparation for this Report

This Report has been prepared in accordance with the typical arboricultural assessment process of large-scale infrastructure projects.

We have also drawn on experience gained through providing specialist arboricultural input and reporting as part of other Te Tupu Ngātahi Projects, on behalf of Waka Kotahi and AT.

4.2 Methodology

The Arboricultural Assessment methodology involved recording details of all trees that may be impacted by the construction and operation of the Project within the proposed designations. Trees in this instance will be any woody plant that is 4 m or greater in height, or that may reach this dimension in the future. In particular, trees that are protected by the AUP:OP, under the District Plan provisions were recorded (e.g. if scheduled (i.e. a Notable Tree), within the road reserve, open space zone or located in an AUP:OP overlay).

The protection status of trees was recorded, based on the current District Plan rules that apply to the tree/s growing location. Those trees protected through District Plan provisions are discussed in this Report in terms of an assessment of effects and potential mitigation measures to address these effects. Those trees protected through Regional Plan provisions are included in this Report to Any regional consent requirements in relation to removal or works proximate to trees covered by the Regional Plan provisions will be assessed through a future resource consent process.

Specifically, this assessment was undertaken using the following methodology:

- An overview Project Team workshop. This workshop defined the proposed corridor and detailed the eight NORs to be assessed as part of the Project;
- A review of the project corridor. Additional information was requested from the Project Team and this informed the initial survey works;
- A high-level desktop survey of all trees and vegetation affected by the Project corridor was undertaken. A high-level route and works footprint plan set were used to inform the initial survey in order to assess the presence of street trees, large areas of densely planted vegetation or significant individual trees (such as Notable Trees);
- The initial survey information was provided to the Project Team in the form of GIS co-ordinates and a excel table with baseline information. The Project Team then transposed this information onto Te Tupu Ngātahi GIS viewer;
- The exact number of trees, areas of vegetation and Notable Trees affected by the proposed works were then refined. This information was then provided to the Project Team and a discussion was held with other discipline specialists including landscape architecture and ecology on potential mitigation;
- For the purposes of this assessment, groups of vegetation were recorded based on the estimated area to be removed. This was measured using the Auckland Council Unitary Plan GIS viewer measurement tool. It was not considered reasonable or practical to record every tree in each group. Furthermore, it is considered the value of this vegetation type is based on its function in that

group as opposed to its value as an individual specimen. A site drive over was undertaken by car to confirm the information was accurate at the time of the desktop survey (March 2022);
- The initial tree and vegetation information has been used to inform the proposed tree and landscape mitigation assessment; and
- This arboricultural assessment has then been prepared to summarise the anticipated arboricultural effects. This Report provides a recommended mitigation strategy, assessment of arboricultural effects in terms of the AUP:OP provisions pertaining to trees and vegetation on roads and open space zoned land and general recommendations from an arboricultural perspective to inform the NORs and supporting documentation.

For the purposes of this Report, vegetation standing on private property is not assessed in terms of effects unless it is subject to a specific overlay in the AUP:OP and is impacted by the Project.

4.3 Statutory Context

4.3.1 Notice of Requirement – district plan requirements

This assessment has been prepared to support the AEE and NOR process. If confirmed, the designations will authorise the District Plan land use components of the Project. Accordingly, when assessing the actual or potential effects on the environment of allowing the requirement in terms of section 171 of the RMA, this assessment has been limited to matters that would trigger a District Plan consent requirement. Where regional consenting requirements are triggered, these will not be authorised by the designation, and will require further regional consents.

In order to demonstrate the split between Regional and District Plan matters, protected trees (under either the Regional or District provisions of the AUP:OP) have been listed in tables and plotted on site plans in the Appendices of this Report. The tables and site plans assist to identify the potential arboricultural effects of the construction of the Project, and whether these are Regional Plan, or District Plan matters under the AUP: OP.

4.3.2 Future Regional Resource Consents

No regional resource consents are currently being sought for the Project. As required these will be sought at a later date during the detailed design and regional consent phase, before construction commences.

4.3.3 District Plan rules

The following tables set out the relevant rules that apply tree protection for the Project under the District Plan and the Regional Plan jurisdiction of the AUP: OP.

AUP:OP jurisdiction	Reference	Rule	Where rule applies	Activity status
DP	E26.4.3 Activity Table	All activities (must) obtain the approval of the Tree Asset Manager	Trees in roads and on open space zones	Mandatory requirement

AUP:OP jurisdiction	Reference	Rule	Where rule applies	Activity status
DP	E26.4.3.1 (A83)	Tree trimming or alteration	Trees in roads and on open space zones	Permitted Activity
DP	E26.4.3.1 (A84)	Tree trimming or alteration that does not comply with Standard E26.4.5.1 (Trees in streets and open space zones) or Standard E.26.4.5.3 (Notable Trees)	Trees in roads and on open space zones	Restricted Discretionary Activity
DP	E26.4.3.1 (A87)	Works within the protected root zone that comply with Standard E26.4.5.2	Trees in roads and on open space zones	Permitted Activity
DP	E26.4.3.1 (A88)	Works within the protected root zone not otherwise provided for	Trees in roads and on open space zones	Restricted Discretionary Activity
DP	E26.4.3.1 (A91)	Tree removal of Notable Trees	Notable Tree overlay	Discretionary
DP	E26.4.3.1 (A91)	Tree alteration or removal of any tree less than 4m in height and/or less than 400mm in girth	Trees in roads and on open space zones	Permitted Activity
DP	E26.4.3.1 (A92)	Tree alteration or removal of any tree greater than 4m in height and/or greater than 400mm in girth (See note 2)	Trees in roads and on open space zones	Restricted Discretionary Activity
DP	E26.4.3.1 (A93)	Tree trimming, alteration or removal not otherwise provided for	Trees in roads and on open space zones	Discretionary Activity
DP	E26.4.3.1	Where land is zoned 'Strategic Transport Corridor' zone, trees are not subject to protection as this land is specified as a 'zone' the relevant zone provisions take precedence over the underlying 'road' which is not a zone under the AUP:OP.. An exception would occur when trees are protected under rules pertaining an AUP rule on adjacent land (such as Open Space zoned land)	Trees in roads	Permitted Activity

Note 1:

Standard E26.5.3.2 Vegetation alteration or removal states:

(1) Must not include trees over 6 m in height, or 600 mm in girth unless their removal is otherwise permitted by a rule in this Plan.

(2) Must not result in the removal of more than 20 m^2 of vegetation within a significant ecological area, except within the formation width of the road.

(3) Must not result in the removal of more than 50 m^2 of vegetation within a coastal area or riparian area not identified as a significant ecological area.

(5) Must not result in the removal of more than 500 m^2 of vegetation within the legal road or the formation width of the road in a rural zone.

(6) Must not result in the removal of more than 250 m^2 of vegetation outside the legal road or the formation width of the road in a rural zone.

5 Existing and likely receiving Arboricultural environment

The projects encompassing the Warkworth NOR package will be constructed 15-25 years from now. The implementation timeframe for each project will vary and correspond with future land release within the area. Assessing the effects on the environment solely as it exists today (i.e., at the time of assessment) will not provide an accurate reflection of the environment in which some of the effects will be experienced. Accordingly, the assessment of effects considers both the existing environment, and the likely receiving environment in which the effects will likely occur.

The Warkworth NOR package will be constructed and will operate alongside existing urban environments or planned future environments (i.e. what can be built under the existing Auckland Unitary Plan: Operative in Part (AUP:OP) and what is identified in the Warkworth Structure Plan):

1. **Existing environment:** A number of corridors comprising the Warkworth NOR package are partially located within/alongside existing urban areas.

a) Matakana Road – residential land uses (single house zone, mixed housing suburban zone, mixed housing urban zone) comprise the western and north-western extents of the corridor.
b) Western Link - South – residential land uses are situated to the north and northwest of the corridor and existing industrial land use on the eastern extent of the corridor.
c) State Highway 1 – South – residential land uses are adjacent to the northwest and southeast of the northern extent of the corridor, additionally there are established business land uses to the northeast of the northern extent of the corridor.
d) Woodcocks Road (Western Section) – the eastern extent of the corridor has existing residential land uses to the north and south.

2. **Future environment**: All the corridors in the Warkworth NOR package will partially or wholly be constructed and implemented on land identified for future growth (future urban zone) and as a result are anticipated to change to urban or industrial land uses.

The likelihood and magnitude of land use change regarding the land use planning context has been identified in Table 4 below. This has been used to inform the assumptions made on the likely future environment

Table 4. Likelihood and magnitude of land use change

Existing environment	Current AUP:OP Zoning	Likelihood of Change for the environment[1]	Magnitude of potential change	Likely Receiving Environment[2]
Residential[3]	Residential (Mixed Housing Suburban)	Low	Low	Residential
	Residential (Mixed Housing Urban)	Low	Low	Residential
	Residential (Single House)	Low	Low	Residential
Business	Business (Mixed Use)	Low	Low	Business (Industrial)
	Business (General Business)			Business (General Business)
	Business (Light Industry)	Low	Low	Business (Industrial)
	Business (Local Centre Zone)	Low	Low	Business (Neighbourhood Centre)
Open Space	Open Space – Conservation Zone	Low	Low	Informal Recreation
Greenfield areas	Future Urban Zone	High	High	Urban
Other	Special Purpose – Quarry Zone	Low	Med	Quarry

Refer to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the Warkworth NOR package.

[1] Based on AUP:OP zoning/policy direction

[2] Based on Warkworth Structure Plan and AUP:OP zoning/policy direction

6 Warkworth NORs – Overall network

This section assesses common or general arboricultural matters across the overall Warkworth Project i.e. the combination of public transport interchanges, existing road upgrades and new corridors. This section also recommends measures to avoid, remedy, or mitigate actual or potential adverse effects for the overall network.

6.1 Overview and description of works

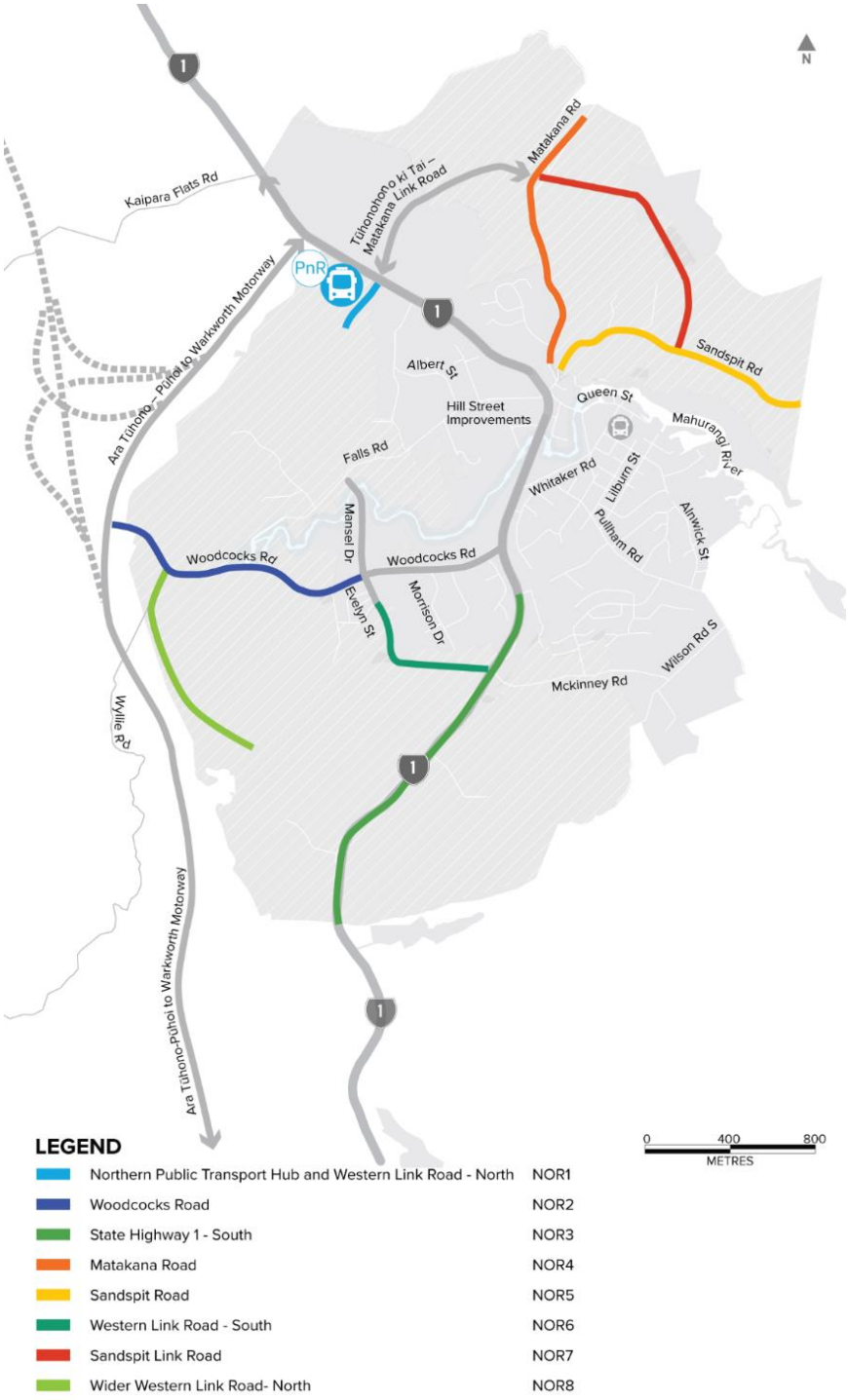

Figure 2 - Overview of project extent

6.2 Positive arboricultural effects

Positive arboricultural effects will occur within all proposed NOR areas when considering the existing land use. No formal public tree plantings on formalised grass berms or within dedicated open space parks or recreational areas occur within NORs 2,3,5 with NoR 3, 6 & 7. These NORs are new connections through greenfield rural environments with little existing tree cover.

The proposed corridor cross sections include sufficient space for a formal berm on both sides of the new corridor for the majority of each route. This will allow for the replanting of new trees in an environment conducive to good tree growth with suitable setbacks provided from future roading infrastructure.

It is noted that in some cases, such as near intersections, that further planting may not be possible.

The full extent of replacement planting cannot be determined at this stage of the process, due to the detailed design to be completed in the future and likely construction timeline for the final Projects being 10 to 25 years into the future.

Figure 3 – Proposed cross section of new roadway demonstrating ability to plant new street trees in a berm area.

6.3 Assessment of operational effects

Operational effects of the Project are largely limited to the maintenance of sight lines and the overhead and lateral clearances of general traffic lanes and the high-quality walking and cycling facilities. The required clearances will largely be limited to existing retained vegetation and newly planted vegetation within the proposed berm area will only require management in the medium term.

6.4 Recommended measures to avoid, remedy or mitigate operational effects

It is recommended that any new street trees or mass planted vegetation (trees specifically) are planted no closer to the future general traffic lanes than 1 m to enable unrestricted future growth.

Once the Project has been constructed, no further effects on trees are anticipated. Ongoing maintenance of street trees and trees retained adjacent to the corridor is a standard operational requirement.

6.5 Summary and Conclusions

Effect	Assessment	Recommendation
Operational		
Tree trimming or alteration	New or replacement trees may require maintenance to retain sight lines and the overhead and lateral clearances of general traffic lanes and the high-quality walking and cycling facilities	New street trees or mass planted vegetation (trees specifically) are planted no closer to the future general traffic lanes than 1 m. This is to be addressed in the ULDMP

Table 5. Summary of Assessment of Effects of Recommendations - Overall network

7 NOR 1 – Northern Public Transport Hub and Western Link - North

The proposed works area for NOR 1 is located on Future Urban zoned land. There are no vegetation areas that are subject to (district) protection. As such, no assessment of trees and vegetation has been undertaken within the NOR 1 area.

It is noted that a permanent stream runs to the south of the main PT hub, with a portion of the Western Link crossing this stream. Any vegetation alteration removal or disturbance would be assessed in the future to determine whether a regional Resource Consent is required (as outlined in Section 4.3.2).

8 NOR 2 – Woodcocks Road (Western Section)

This section assesses specific arboricultural matters relating to NOR 2 – Woodcocks Road (Western Section).

8.1 Overview and description of works

Woodcocks Road (western section) is an existing arterial extending from the interchange with Ara Tūhono in the west to the Mansell Drive intersection in the east. It is proposed to upgrade the existing corridor to a two-lane urban arterial with cycling and walking facilities on both sides of the corridor.

The proposed upgrade will provide a key east-west connection for all modes between existing SH1 and the western growth area in Warkworth. Additionally, the corridor connects to key future north south links including the Wider Western Link – North and Western Link - South. The upgrade will also improve active mode user safety along the corridor.

The proposed works will include the removal of all trees and vegetation along the existing road corridor. The adjacent land is zoned Future Urban, with vegetation within the road corridor, for the most part, not subject to protection due to this adjacent zoning.

8.2 Existing Environment

Woodcocks Road is largely typical of a rural road with predominately self-seeded weed species and indigenous vegetation growing along the road frontages and private property vegetation extending into Road Reserve.

Two small areas adjacent to the existing road corridor are subject to an Open Space-Conservation Zone overlay. This land is adjacent to an existing stream and 286 Woodcocks Road, with this zoning applicable to both the northern and southern sides of Woodcocks Road.

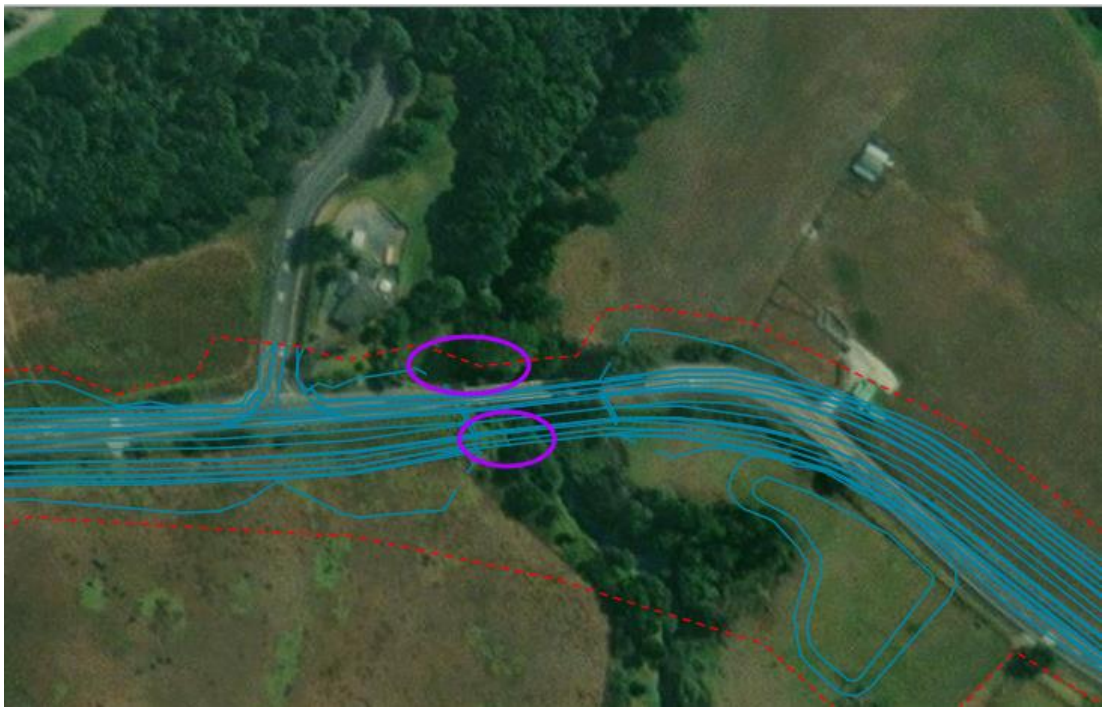

Figure 4 – Two protected open space areas circled in Purple above within NOR 2

8.2.1 286 Woodcocks Road

The proposed works footprint will largely involve the removal of vegetation to the south of the existing bridge area. However, it is anticipated that some tree and vegetation disturbance will occur to the north in the area directly adjacent to the existing bridge structure. Vegetation within this area includes a mixture of exotic and indigenous species including some weed species vegetation. The most significant trees in this location include a number of large Totara (*Podocarpus totara)* on the northern side and mixed weed species vegetation including Hawthorn (*Crategus monogyna*) and Willow (*Salix sp.)* and at least (2) semi-mature Totara growing on the southern side. It is anticipated that all vegetation to the south of the bridge within the designated area would be removed. Works within the protected root zone of vegetation to the north would also be anticipated but would be subject to detailed design.

8.2.2 Road Reserve adjacent to 141 Carran Road

This particular area is heavily vegetated with predominantly indigenous vegetation. The trees and vegetation directly adjacent to the road largely include Manuka (*Leptospernum scorparium)*, Ti Kouka (*Cordyline australis)*, Karamu (*Coprosma robusta)* and a variety of weed species. The more significant vegetation, being primarily mature Totara, is set back further from the existing road edge and largely stands outside of the proposed designation area. Approximately eight (8) Totara stand within the designated area. Currently they are shown outside of the main works area. However, as with all NOR sections, detailed design is required to determine the exact level of impact.

Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the overall Warkworth package.

8.3 Positive Arboricultural effects

The proposed infrastructure upgrades will include the formation of a new formal road corridor. This road corridor includes a provision for a new grass berm to be formally planted with street trees. Considering the largely sporadic nature of vegetation within a rural road setting, formal street tree plantings will improve the overall structure and number of trees planted within this section.

Overall, it is anticipated that the number of new plantings would outweigh the number of trees proposed for removal within the designated area, both protected and non-protected.

8.4 Assessment of construction effects

The Key features of the proposed new corridor affecting trees and vegetation will include the following:

− Upgrading the corridor to a two-lane urban arterial with walking and cycling facilities on both sides of the corridor.

− Tie-ins with existing roads, stormwater wetland and culverts.

− Batter slopes to enable widening of the corridor, and associated cut and fill activities (earthworks).

− Upgraded crossing over the Mahurangi River− Other construction related activities required outside the permanent corridor including the re-grade

of driveways, construction traffic manoeuvring and construction laydown areas.

An indicative Construction Methodology is provided at Appendix 1.

In order to undertake the above works, it is anticipated that all vegetation within the footprint of the proposed alignment would require removal. Further assessment would be required at the time of detailed design to establish the viability of the retention of any trees at the edge or overhanging the proposed alignment or associated earthworks.

8.5 Recommended measures to avoid, remedy or mitigate construction effects

8.5.1.1 Tree Removal and Replacement Planting

As noted previously, the removal of trees on both sides of the proposed corridor will be required throughout the entire corridor to enable the works.

The new berm areas will be available for replacement planting, with it recommended that all available berm be utilised for new tree plantings. The final landscape design should be reviewed and arboricultural input provided prior to implementation to ensure tree species selection and locations are suitable from a long-term perspective.

A Tree Management Plan (**TMP**) should be developed prior to construction to identify existing trees protected under the District Plan provisions that require removal and detail methods for all work within the root zone of trees that are to be retained. The TMP should include:

- Confirmation that protected trees identified in **Appendix A** still exist;
- Advice on how the design and location of works can avoid, remedy or mitigate effects on the existing trees;
- Recommended planting to replace trees that require removal;
- Establishing tree protection zones and specifying tree protection measures such as protective fencing, ground protection and physical protection of roots, trunks and branches; and
- Detailing methods for all work within the root zone of trees that are to be retained in line with appropriate arboricultural standards.

Replacement planting will be decided through planting details for the Project under the Urban Landscape Design Management Plan (**ULDMP**) proposed as a condition on the designation. The ULDMP should also include detail of methodologies to establish new trees within the road reserve, including creation of quality below ground environments, correct planting and appropriate maintenance.

For the NORs, the TMP will be limited to the identification of trees protected under the District Plan, as trees protected under Regional Plan provisions will be addressed as part of a future resource consent process. Consideration of tree transplanting should be included in the TMP, where good quality trees in the road reserve are identified for removal. An assessment of the quality of the trees and the feasibility of transplantation should form part of the TMP.

8.5.1.2 Mass vegetation removal

In the case of the removal of the naturally occurring or planted vegetation near the bridge (Groups 201 & 202), care must be taken to minimise any construction impacts in terms of the fragmentation of the remaining vegetation beyond the proposed removed areas.

Where practicable, the works area must be kept to a minimum, with retaining walls utilised in place of batters where adjacent to retained vegetation. Edge effects must be management appropriately in the management of construction machinery required to avoid unnecessary temporary effects.

A specific assessment and recommendations are to be provided as part of the preparation of the TMP. These recommendations must include a tree protection methodology and set out parameters for the management of the ongoing health of any retained trees.

In some cases, it may be possible to transplant/relocate some specimen trees in these areas. A detailed transplant assessment should be prepared at the time of detailed design. The transplant assessment is to include maintenance periods, methodology of transplant and the new location for each relocated tree.

8.6 Assessment of operational effects

No additional effects to those overall effects identified in section 6.3 of this Report

8.7 Recommended measures to avoid, remedy or mitigate operational effects

Nil. Refer to section 6.4 of this Report.

8.8 Summary and Conclusions

The Project works affect two (2) groups in the road reserve with an adjacent open space zoning. The works are likely to have adverse effects on these trees. The extent of clearance where practical should be minimised, with all remaining significant trees retained and protected where possible during the Project works. Where retention is not possible any removed tree is to be replaced with new trees as part of the TMP. Provided this can be achieved, the effects on these trees will be mitigated.

Effect	Assessment	Recommendation
Construction		
Removal of trees to enable the Project	The removal of 2 tree groups will require removal to enable the Project in this section	Replacement planting at a minimum of 2:1. The replacement of mass planted indigenous vegetation is recommended for this section. Replacement planting will be decided through planting details for the Project under the ULDMP proposed as a condition on the designation. The methodology for protection is to be included in the TMP.
Operation		
Tree trimming or alteration	Replacement trees may require maintenance to retain sight lines and the overhead and lateral clearances of general traffic lanes and the high quality walking and cycling facilities	New street trees or mass planted vegetation (trees specifically) are planted no closer to the future general traffic lanes than 1 m.

9 NOR 3 – State Highway 1 – South

This section assesses specific arboricultural matters relating to NOR 3 – State Highway 1 - South.

9.1 Overview and description of works

NOR 3 comprises of a section of SH1 running from just south of the intersection of Valerie Road northwards to just north of ‘The Grange’ shopping mall (Fairwater Road Intersection)

The land adjacent to SH1 from Valerie Close to Mckinney Road is zoned 'Future Urban Zone'. From that point north, the adjacent land is zoned residential or business zone. The existing road corridor is also subject to a 'Strategic Transport Corridor Zoning'.

All trees within Road Reserve for this portion of the route are not subject to protection due to either the adjacent FUZ zoning or their location being within the 'Strategic Corridor' zoned land parcel.

Refer back to the AEE in Volume 2 for a more detailed description of works to be authorised.

9.2 Assessment Features

While no tree protection is afforded to vegetation within this NOR, it is considered important to record significant trees and vegetation within the road corridor for consideration in a future assessment. The locations and general details of this vegetation is outlined in Appendix A of this report.

Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the overall Warkworth package.

10 NOR 4 – Matakana Road

This section assesses specific arboricultural matters relating to NOR 4 – Matakana Road.

10.1 Overview and description of works

NOR 4 comprises of a section of Matakana Road from the Sandspit Road intersection in the south to just north of Clayden Road (adjacent to 306 Matakana Road).

The western side of Matakana Road throughout this section transitions from residential zoned land to rural zoned land. The eastern side is almost exclusively zoned 'Future Urban'.

In consideration of these adjacent zones, vegetation on the western side of Matakana Road is subject to protection under the relevant E26. provisions relating to vegetation on Road Reserve. Trees on the eastern side are not protected due to the adjacent land zoning being either FUZ or Rural.

Refer back to the AEE in Volume 2 for a more detailed description of works to be authorised.

10.2 Assessment Features

The most significant vegetation within the NOR 4 designation is located in the southern portion either on or adjacent to the existing Road Reserve. Dense areas/plantings of mixed exotic and indigenous vegetation is growing adjacent to the road corridor from the Matakana Road/Sandspit Road intersection adjacent to the residential zoned land. This planting reduces in density from where the residential land transitions from Residential - Single House zoned land (19 Northwood Close southward) to Residential -Mixed Housing Urban zoned land (165 Matakana Road northward).

The main vegetation within this area is identified as emergent to semi-mature Totara, large areas of Tree Privet (*Ligustrum lucidum)* and an area of SEA characterized by a mixture of weed species vegetation, planted exotic garden variety species, as well as planted and emergent pioneer indigenous species. Emergent species include Karamu (*Coprosma robusta)*, Ti Kouka (*Cordyline*

australis), Tarata (*Pittosporum eugenioides)*, Kohuhu (*Pittosporum tenuifolium)* and Karo (*Pittosporum crassifolium)*.

Two (2) Notable trees and a Notable tree grouping (AUP ID 2421 & 2422), being a Deodar Cedar (*Cedrus deodara)* and Sweet Gum (*Liquidambar styraciflua)* and a group of Totara (*Podocarpus totara)* are growing within 3 Matakana Road. Based on a review of proposed designation boundary, any future works will be largely clear of the root zone of the Cedar tree and the Totara grouping, located near to the existing public footpath. The Liquidambar is further within the site and will not be affected. All works near to the Cedar tree are to be assessed from an arboricultural perspective, with the management of works near these trees to be included in the future TMP.

A scattering of planted street trees are growing on the western side of Matakana Road adjacent to the residential zoned land. These include two (2) Pohutukawa (*Metrosideros excelsa)* and a cluster of three (3) exotic trees which include a Sweet Chestnut *(Castanea sativa)* Gleditsia (*Gleditsia triacanthos*) and Pin Oak (*Quercus palustris).*

The proposed works within the designation will include cut/fill works adjacent to the new roading layout. As such, it is anticipated that all vegetation growing within Road Reserve would be removed.

Trees and vegetation growing within the adjacent properties are likely to be affected by these works and may require removal. In the case of the eastern side of Matakana Road, this area is zoned FUZ and as such the existing vegetation densities on private property is likely to change in the future.

Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the overall Warkworth package.

Figure 5 – Notable trees within Matakana Road as seen from the Matakana Road carriageway

Figure 6 – Image showing typical mass vegetation within this NOR

10.3 Positive arboricultural effects

As with the previous sections, the proposed infrastructure upgrades will include the formation of a new formal road corridor. This road corridor includes a provision for a new grass berm to be formally planted with street trees. Considering the largely sporadic nature of vegetation within a rural road setting, formal street tree plantings will improve the overall structure and number of trees planted within this section within the public realm.

10.4 Assessment of construction effects

The Key features of the proposed new corridor affecting trees and vegetation will include the following:

Upgrading Matakana Road to accommodate the above-mentioned section cross-sections with cycle lanes and footpaths on both sides of the corridor.

- Tie-ins with existing roads, stormwater dry ponds, wetlands and culverts.
- Likely posted speed of 50kph, design speed (of which effects will be assessed on) is 60 kph
- Batter slopes to enable widening of the corridor, and associated cut and fill activities.
- Vegetation removal along the existing road corridor
- Other construction related activities required outside the permanent corridor including the re-grade

of driveways, construction traffic maneuvering and construction laydown areas.

The indicative form and function details and a cross section of the Matakana Road Upgrade are identified in the figure below:

Figure7 – Overview of the Matakana Road Upgrade

10.5 Recommended measures to avoid, remedy or mitigate construction effects

10.5.1.1 Tree Removal and Replacement Planting

As noted previously, the removal of trees or groups of trees on both sides of the proposed corridor will be required throughout the entire corridor to enable the works.

The new berm areas will be available for replacement planting, with it recommended that all available berm be utilised for new tree plantings. The final landscape design should be reviewed and arboricultural input provided prior to implementation to ensure tree species selection and locations are suitable from a long-term perspective.

A Tree Management Plan (**TMP**) should be developed prior to construction to identify existing trees protected under the District Plan provisions that require removal and detail methods for all work within the root zone of trees that are to be retained. The TMP should include:

- Confirmation that protected trees identified in **Appendix A** still exist;
- Advice on how the design and location of works can avoid, remedy or mitigate effects on the existing trees;
- Recommended planting to replace trees that require removal;
- Establishing tree protection zones and specifying tree protection measures such as protective fencing, ground protection and physical protection of roots, trunks and branches; and
- Detailing methods for all work within the root zone of trees that are to be retained in line with appropriate arboricultural standards.

Replacement planting will be decided through planting details for the Project under the Urban Landscape Design Management Plan (**ULDMP**) proposed as a condition on the designation. The ULDMP should also include detail of methodologies to establish new trees within the road reserve, including creation of quality below ground environments, correct planting and appropriate maintenance.

For the NORs, the TMP will be limited to the identification of trees protected under the District Plan, as trees protected under Regional Plan provisions will be addressed as part of a future resource consent process. Consideration of tree transplanting should be included in the TMP, where good quality trees in the road reserve are identified for removal. An assessment of the quality of the trees and the feasibility of transplantation should form part of the TMP.

10.5.1.2 Mass vegetation removal

In the case of the removal of the mass planted or naturally occurring vegetation throughout NOR 3 within the existing road reserve, care must be taken to minimise any construction impacts in terms of the fragmentation of the remaining vegetation on adjacent private land or on residual land beyond the proposed removed areas.

Where practicable, the works area must be kept to a minimum, with retaining walls utilised in place of batters where adjacent to retained vegetation. Edge effects must be management appropriately in the management of construction machinery required to avoid unnecessary temporary effects.

A specific assessment and recommendations are to be provided as part of the preparation of the TMP. These recommendations must include a tree protection methodology and set out parameters for the management of the ongoing health of any retained trees.

In some cases, it may be possible to transplant/relocate some specimen trees in these areas. A detailed transplant assessment should be prepared at the time of detailed design. The transplant assessment is to include maintenance periods, methodology of transplant and the new location for each relocated tree.

10.6 Assessment of operational effects

Refer to section 6.3 of this Report

10.7 Recommended measures to avoid, remedy or mitigate operational effects

Refer to section 6.4 of this Report.

10.8 Summary and Conclusions

The Project works directly affect 5 protected trees and 3 groups in the road reserve and open space zoned areas. The works are likely to have adverse effects on these trees. Provided that these trees are retained and protected where possible during the Project works, or they are replaced with new trees as part of the CDEMP the effects on these trees will be mitigated.

Effect	Assessment	Recommendation
Construction		
Removal of trees to enable the Project	The removal of 5 individual trees and 3 tree groups will require removal to enable the Project in this section	Replacement planting at a minimum of 2:1. The replacement of mass planted indigenous vegetation is recommended for this section. Replacement planting will be decided through planting details for the Project under the ULDMP proposed as a condition on the designation. The methodology for protection is to be included in the TMP.
Operation		
Tree trimming or alteration	Replacement trees may require maintenance to retain sight lines and the overhead and lateral clearances of general traffic lanes and the high quality walking and cycling facilities	New street trees or mass planted vegetation (trees specifically) are planted no closer to the future general traffic lanes than 1 m.

11 NOR 5 – Sandspit Road

This section assesses specific arboricultural matters relating to NOR 5 – Sandspit Road.

11.1 Overview and description of works

Sandspit Road is an existing arterial providing east-west connection between the Warkworth growth area and the towns of Sandspit and Snells Beach. This project extends from the tie in with the Hill Street intersection upgrade Project (non-SGA project) in the west and to the eastern Future Urban Zone boundary.

The majority of road reserve in this section is adjacent to FUZ and as such those trees within such areas are not subject to protection. Near the southern end of Sandspit Road, three open space zoned areas are abutting road reserve on Sandspit road between the Matakana Road intersection and Withers Lane. Based on the current NOR designation layout, the main area to be effected will be the section on the southern side of Sandspit Road, identified as Lot 7 DP138902 in the AUP.

All vegetation in excess of 4.0m in height or 400mm in girth is subject to protection.

Refer back to the AEE in Volume 2 for a more detailed description of works to be authorized

Figure 8 – AUP viewer plan showing areas of Open Space zoned land (in green)

Figure 9 - Proposed Designation showing adjacent land effects.

11.2 Assessment Features

The protected areas outlined in the previous section are typical of the wider indigenous vegetation, as described in Section 10.2 and is heavily weed infested.

The larger, more significant trees, being largely mature Totara, are located on the upper bank section of the two northern sections (Lot 5 DP208832 & 155310 respectively),. However, the large significant trees (also largely Totara) are at the edge or overhang the existing road corridor on the southern section side.

For this reason, the proposed designation alignment is largely to the north, to make use of the lesser value buffer vegetation directly adjacent to 89 Sandspit Road.

Care has been taken to anticipate a corridor that will reduce the effects on the more significant trees and vegetation within this section.

Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the overall Warkworth package.

Figure 10 – Vegetation within Open Space areas adjacent to Sandspit Road

11.3 Positive arboricultural effects

As with the previous sections, the proposed infrastructure upgrades will include the formation of a new formal road corridor. This road corridor includes a provision for a new grass berm to be formally planted with street trees. Considering the largely sporadic nature of vegetation within a rural road setting, formal street tree plantings will improve the overall structure and number of trees planted within this section within the public realm. It is anticipated that, based on the designation boundaries, that the more significant vegetation growing within the SEA areas will be retained and protected as part of the future works.

11.4 Assessment of construction effects

The Key features of the proposed new corridor affecting trees and vegetation will include the following:

Upgrading Sandspit Road to accommodate a two-lane cross-section with cycle lanes and footpaths on both sides of the corridor.

- Construction of two stream bridges
- Tie-ins with existing roads, stormwater dry ponds, wetlands and culverts.
- Likely posted speed of 50kph, design speed (of which effects will be assessed on) is 60 kph
- Batter slopes to enable widening of the corridor, and associated cut and fill activities.
- Vegetation removal along the existing road corridor
- Other construction related activities required outside the permanent corridor including the re-grade of driveways, construction traffic manoeuvring and construction laydown areas.

Figure 11– Sandspit Road Upgrade indicative layout

Recommended measures to avoid, remedy or mitigate construction effects

11.4.1.1 Tree Removal and Replacement Planting

As noted previously, the removal of trees on both sides of the proposed corridor will be required throughout the entire corridor to enable the works.

The new berm areas will be available for replacement planting, with it recommended that all available berm be utilised for new tree plantings. The final landscape design should be reviewed and arboricultural input provided prior to implementation to ensure tree species selection and locations are suitable from a long-term perspective.

A Tree Management Plan (**TMP**) should be developed prior to construction to identify existing trees protected under the District Plan provisions that require removal and detail methods for all work within the root zone of trees that are to be retained. The TMP should include:

- Confirmation that protected trees identified in **Appendix A** still exist;
- Advice on how the design and location of works can avoid, remedy or mitigate effects on the existing trees;
- Recommended planting to replace trees that require removal;
- Establishing tree protection zones and specifying tree protection measures such as protective fencing, ground protection and physical protection of roots, trunks and branches; and
- Detailing methods for all work within the root zone of trees that are to be retained in line with appropriate arboricultural standards.

Replacement planting will be decided through planting details for the Project under the Urban Landscape Design Management Plan (**ULDMP**) proposed as a condition on the designation. The ULDMP should also include detail of methodologies to establish new trees within the road reserve, including creation of quality below ground environments, correct planting and appropriate maintenance.

For the NORs, the TMP will be limited to the identification of trees protected under the District Plan, as trees protected under Regional Plan provisions will be addressed as part of a future resource consent process. Consideration of tree transplanting should be included in the TMP, where good quality trees in the road reserve are identified for removal. An assessment of the quality of the trees and the feasibility of transplantation should form part of the TMP.

11.4.1.2 Mass vegetation removal

In the case of the removal of the mass planted or naturally vegetation within the protected areas as part of NOR 5, care must be taken to minimise any construction impacts in terms of the fragmentation of the remaining vegetation beyond the proposed removed areas.

Where practicable, the works area must be kept to a minimum, with retaining walls utilised in place of batters where adjacent to retained vegetation. Edge effects must be management appropriately in the management of construction machinery required to avoid unnecessary temporary effects.

A specific assessment and recommendations are to be provided as part of the preparation of the TMP. These recommendations must include a tree protection methodology and set out parameters for the management of the ongoing health of any retained trees.

In some cases, it may be possible to transplant/relocate some specimen trees in these areas. A detailed transplant assessment should be prepared at the time of detailed design. The transplant assessment is to include maintenance periods, methodology of transplant and the new location for each relocated tree.

11.5 Assessment of operational effects

Nil. Refer to section 6.3 of this Report

11.6 Recommended measures to avoid, remedy or mitigate operational effects

Nil. Refer to section 6.4 of this Report.

11.7 Summary and Conclusions

The Project works affect 5 protected trees and 3 groups in the road reserve and open space zoned areas. The works are likely to have adverse effects on these trees. Provided that these trees are retained and protected where possible during the Project works, or they are replaced with new trees as part of the TMP the effects on these trees will be mitigated.

Effect	Assessment	Recommendation
Construction		
Removal of trees to enable the Project	The removal selected trees and vegetation from within road reserve (adjacent to open space zoned land) or within open space zoned land to enable the Project in this section	Replacement planting at a minimum of 2:1. The replacement of mass planted indigenous vegetation is recommended for this section. Replacement planting will be decided through planting details for the Project under the ULDMP proposed as a condition on the designation. The methodology for protection is to be included in the TMP.
Operation		
Tree trimming or alteration	Replacement trees may require maintenance to retain sight lines and the overhead and lateral clearances of general traffic lanes and the high quality walking and cycling facilities	New street trees or mass planted vegetation (trees specifically) are planted no closer to the future general traffic lanes than 1 m.

12 NOR 6 – Western Link - South

This section assesses specific arboricultural matters relating to NOR 6 – Western Link - South

12.1 Overview and description of works

The Western Link - South is located at the end of Evelyn Street in the north to SH1 in the south and runs through existing greenfield land. The Western Link - South Project involves the construction of a new two-lane urban arterial with walking and cycling facilities on both sides and upgrading the intersection with McKinney Road. The new corridor will provide key north-south connection in the Warkworth network.

The purpose of the Western Link is to enable development in west Warkworth and provide access to FUZ land and industrial areas while taking pressure off the existing SH1 and Hill Street intersection Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the overall Warkworth package.

The Western Link travels through an area of farmland largely devoid of trees and vegetation. No SEA areas or vegetation protected under district plan measures was identified.

As such, no further assessment of this NOR is provided in this assessment.

13 NOR 7 – Sandspit Link

This section assesses specific arboricultural matters relating to NOR 7 – Sandspit Link.

13.1 Overview and description of works

Sandspit Link is a proposed new road with the purpose of providing strategic east-west movements to Matakana and Kowhai Coasts and providing local access to the northern growth area. The corridor extends from Matakana Road in the north-west and connects to Sandspit Road in the southeast.

The alignment provides a resilient alternative to SH1 and Hill Street Intersection whilst improving dual accessibility between the northern growth area and Warkworth. The Sandspit Link Project involves the construction of a two-lane urban arterial with cycle lanes and footpaths on both sides and a new intersection at the connection with Sandspit Road.

The Sandspit Link travels through FUZ zoned land which is primarily in farmland largely devoid of trees and vegetation, with the exception of riparian areas adjacent to streams. No SEA areas or vegetation protected under district plan measures was identified.

As such, no further assessment of this NOR is provided in this assessment.

14 NOR 8 – Wider Western Link - North

This section assesses specific arboricultural matters relating to NOR 8 – Wider Western Link – North.

14.1 Overview and description of works

The Wider Western Link - North is a proposed new arterial extending from Woodcocks Road in the north to SH1 in the south. The extent of the proposed new Wider Western Link - North is from Woodcocks Road to the Mahurangi River crossing.

The Wider Western Link - North project involves the construction of a two-lane urban arterial with walking and cycling facilities on both sides. The corridor connects the Southern Interchange to Woodcocks Road and SH1 and, provides access into the southern FUZ where access will otherwise be difficult due to topography and streams.

No specific trees or vegetation have been assessed as part of this NOR. It is anticipated a regional resource consent will be required at a future stage for works involving the crossing at the Mahurangi stream.

Refer back to the AEE in Volume 2 for a more detailed description of works to be authorised.

15 Conclusions

The existing environment for the majority of the Project corridor is primarily rural or Future Urban Zone, the exception being areas of residential zoned land on Matakana Road, State Highway 1 and Woodcocks Road. Tree cover associated with the existing rural environments typically include plantings of amenity trees, naturally occurring emergent and established indigenous mass planted areas and riparian vegetation within the road reserve and open space zones.

The future environment is likely to change over the next 10 – 25 years as intensification occurs along the corridor as a result of recent changes in national policy direction and changes to the Resource Management Act 1991 (**RMA**). This will likely result in a reduction of trees adjoining the corridor, on business and residentially zoned land, which are not afforded any protection in the Auckland Unitary Plan: Operative in part (**AUP:OP**).

A summary of the trees or vegetation requiring removal for each NOR, which are protected by District Plan provisions in the AUP:OP is provided in the table below:

NoR	Number of Protected Trees/ Requiring Removal	Mass planted areas/groups of protected vegetation requiring removal
NOR 1	0	0
NOR 2	0	2
NOR 3	0	0
NOR 4	5	2
NOR 5	0	1
NOR 6	0	0

NoR	Number of Protected Trees/ Requiring Removal	Mass planted areas/groups of protected vegetation requiring removal
NOR 7	0	0
NOR 8	0	0
Total	**5**	**21**

It is recommended that a Tree Management Plan (**TMP**) be developed where construction work impacts on trees and groups of trees that are protected under the District Plan provisions. Trees protected under Regional Plan provisions will be addressed as part of a future regional resource consent process. Replacement planting protocols are proposed to be developed further as part of the TMP where protected trees are to be removed.

The designation provides for sufficient opportunities for replanting within the berms of the future potential corridor cross section(s) to provide mitigation of potential effects which may arise from tree removal associated with the Project. The long-term outcome of comprehensive street tree planting will be more trees in the public realm and increased amenity value within the public transport corridor.

Overall, the effects on trees protected by the District Plan by the NORs for the Project will be mitigated by replacement with new trees and mass planted vegetation as part of the corridor.

1 Appendix A: Tree Information

NOR 2							
Status	**Tree No.**	**Vegetation Type**	**Protection**	**Location**	**Species**	**Age**	**Comments**
Likely to be removed/ portion to be removed.	201	Group of Trees	Road Reserve (adjacent to open space zoned land)	Northern side of Woodcocks Road (adjacent to stream and 286 Woodcocks Road	Totara & Poplar, mixed shrubs	Semi - Mature	Power lines crossing bridge in this location. Some effects as part of bridge works anticipated
Likely to be removed/ portion to be removed.	202	Group of Trees	Road Reserve (adjacent to open space zoned land)	Southern side of Woodcocks Road	Exotic and native shrubs / hedge/ small Totara	Young-semi-mature	Removal of trees/shrubs in this area for widening works.

NOR 3							
Status	Tree No.	Vegetation Type	Protection	Location	Species	Age	Comments
Strategic Corridor	330	Single tree	Road Reserve	SH1	London Plane	Mature	
Strategic Corridor	329	Single tree	Road Reserve	SH1	London Plane	Mature	
Strategic Corridor	328	Single tree	Road Reserve	SH1	Sophora teptraptera	Mature	
Strategic Corridor	327	Single tree	Road Reserve	SH1	London Plane	Mature	
Strategic Corridor	326	Single tree	Road Reserve	SH1	Sophora teptraptera	Mature	
Strategic Corridor	325	Single tree	Road Reserve	SH1	Sophora teptraptera	Mature	
Strategic Corridor	324	Single tree	Road Reserve	SH1	Sophora teptraptera	Mature	
Strategic Corridor	323	Single tree	Road Reserve	SH1	Sophora teptraptera	Mature	
Strategic Corridor	342	Single tree	Road Reserve	SH1	London Plane	Mature	
Strategic Corridor	341	Single tree	Road Reserve	SH1	London Plane	Mature	
Strategic Corridor	340	Single tree	Road Reserve	SH1	London Plane	Mature	

NOR 3							
Strategic Corridor	339	Single tree	Road Reserve	SH1	London Plane	Mature	
Strategic Corridor	338	Single tree	Road Reserve	SH1	London Plane	Mature	
Strategic Corridor	337	Single tree	Road Reserve	SH1	London Plane	Mature	
Strategic Corridor	322	Single tree	Road Reserve	SH1	Kowhai	Mature	
Strategic Corridor	321	Single tree	Road Reserve	SH1	Kowhai	Mature	
Strategic Corridor	320	Single tree	Road Reserve	SH1	Kowhai	Mature	
Strategic Corridor	335	Single tree	Road Reserve	SH1	London Plane	Mature	
Strategic Corridor	334	Single tree	Open Space	SH1	London Plane	Mature	
Strategic Corridor	336	Single tree	Road Reserve	SH1	London Plane	Mature	
Strategic Corridor	331	Group of Trees	Road Reserve	SH1	Black Wattle	Semi - Mature	
Strategic Corridor	319	Single tree	Road Reserve	SH1	London Plane	Mature	
Strategic Corridor	346	Single tree	Road Reserve	SH1	Kowhai	Mature	
Strategic Corridor	345	Single tree	Road Reserve	SH1	Plane tree	Semi - Mature	

NOR 3							
Strategic Corridor	344	Single tree	Road Reserve	SH1	Plane tree	Semi - Mature	
Strategic Corridor	315	Group of Trees	Road Reserve	SH1	Black Wattle		
Strategic Corridor	343	Group of Trees	Road Reserve	SH1	Privet. Nikau. Bottlebrush.	Young	
Strategic Corridor	308	Single tree	Road Reserve	SH1	Eucalypt	Mature	
Strategic Corridor	309	Single tree	Road Reserve	SH1	Melia	Mature	
Strategic Corridor	310	Single tree	Road Reserve	SH1	Melia		
Strategic Corridor	312	Group of Trees	SEA		Totara		
Strategic Corridor	311	Group of Trees	Road Reserve	SH1	Melia	Semi - Mature	
Strategic Corridor	306	Group of Trees	SEA	SH1	Totara		
Strategic Corridor	305	Group of Trees	Riparian Margin	SH1	Poplar, Privet, Totara, Willow		
Strategic Corridor	304	Group of Trees	Riparian Margin	SH1	Poplar Privet Totara Kowhai		
Strategic Corridor	303	Group of Trees	Road Reserve	SH1	Mixed, poplar, kanuka, Privet, Pohutukawa	Mature	
Strategic Corridor	333	Single tree	Road Reserve	SH1	Gum		

NOR 3							
Strategic Corridor	332	Group of Trees	Road Reserve	SH1	Kanuka	Semi - Mature	
Strategic Corridor	317	Group of Trees	Road Reserve	SH1	Pine	Young	
Strategic Corridor	316	Group of Trees	Road Reserve	SH1	Pine	Semi - Mature	
Strategic Corridor	314	Group of Trees	Road Reserve	SH1	Pine	Mature	
Strategic Corridor	318	Single tree	Road Reserve	SH1	Pine	Mature	
Strategic Corridor	313	Single tree	Road Reserve	SH1	Gum	Semi - Mature	
Within Designation - Effects Unknown	302	Group of Trees	Riparian Margin	SH1	Kanuka, Totara, Kowhai, Privet	Mature	

NOR 4							
Status	**Tree No.**	**Vegetation Type**	**Protection**	**Location**	**Species**	**Age**	**Comments**
Likely to be removed	407	Single tree	Road Reserve	Matakana Road	Pohutukawa	Semi - Mature	Adjacent to residential zoned land. Remove for future road works
Likely to be removed	408	Single tree	Road Reserve	Matakana Road	Pohutukawa	Semi - Mature	Adjacent to residential zoned land. Remove for future road works
Likely to be removed	405	Group of Trees	Road Reserve	Matakana Road	Totara/Weed Species/mixed pioneer natives	Mature	Adjacent to residential zoned land. Remove for future road works
Likely to be removed	404	Group of Trees	Road Reserve	Matakana Road	Totara/Weed Species/mixed pioneer natives	Mature	Adjacent to residential zoned land. Remove for future road works
Likely to be removed	403	Single tree	Road Reserve	Matakana Road	Sweet Chestnut	Semi - Mature	
Likely to be removed	402	Single tree	Road Reserve	Matakana Road	Gleditsia	Semi - Mature	
Likely to be removed	401	Single tree	Road Reserve	Matakana Road	Pin Oak	Mature	

NOR 4

Status	Tree No.	Vegetation Type	Protection	Location	Species	Age	Comments
Retain and Protect	409	Single Tree	Notable Tree	3 Matakana Road	Liquidambar	Mature	Retain and protect for duration of works. TMP protection measures to be applied
Retain and Protect	410	Single Tree	Notable Tree	3 Matakana Road	Deodar Cedar	Mature	Retain and protect for duration of works. TMP protection measures to be applied
Retain and Protect	411	Group of Trees	Notable Tree	3 Matakana Road	Totara Group	Mature	Retain and protect for duration of works. TMP protection measures to be applied

NOR 5

Status	Tree No.	Vegetation Type	Protection	Location	Species	Age	Comments
Within Designation - Effects Unknown	501	Group of Trees	Road Reserve (standing adjacent to open space zoned land	Sandspit road	Totara , Titoki, Karaka/ mixed native vegetation	Mature	No significant impacts anticipated. Main works on southern side of Sandspit road

NOR 5							
Within Designation - Effects Unknown	503	Group of Trees	Road Reserve (standing adjacent to open space zoned land	Sandspit road	Nikau, Phoenix palm, Totara, Privet, Pohutukawa, Lemonwood/Mixed Native vegetation	Mature	No significant impacts anticipated. Main works on southern side of Sandspit road
Some trees/ portion to be removed.	502	Group of Trees	Road Reserve (standing adjacent to open space zoned land	Sandspit road	Totara , Titoki, Karaka/ mixed native vegetation/mixed climate species	Mature	Some removal of vegetation anticipated. Fringe effects will need to be monitored. Exact extent of removal to be measures and suitably mitigated.

ATTACHMENT 62

ASSESSMENT OF ARCHAEOLOGICAL AND HERITAGE EFFECTS

TE TUPU NGĀTAHI
SUPPORTING GROWTH

Warkworth Assessment of Archaeological and Heritage Effects

May 2023

Version 1.0

Document Status

Responsibility	Name
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Revision Status

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1.0	12/05/2023	Issue for Lodgement

Table of Contents

Glossary of Defined Terms and Acronyms

Acronym/Term	Description
AEE	Assessment of Effects on the Environment report
AT	Auckland Transport
AUP:OP	Auckland Unitary Plan: Operative in Part
CHI	Cultural Heritage Inventory
HNZPT	Heritage New Zealand Pouhere Taonga
HNZPTA	Heritage New Zealand Pouhere Taonga Act 2014
N/A	Not Applicable
NOR	Notice of Requirement
NOR 1	Northern Public Transport Hub and Western Link - North
NOR 2	Woodcocks Road – West Upgrade
NOR 3	State Highway 1 – South Upgrade
NOR 4	Matakana Road Upgrade
NOR 5	Sandspit Road Upgrade
NOR 6	Western Link - South
NOR 7	Sandspit Link
NOR 8	Wider Western Link – North
NZAA	New Zealand Archaeological Association
RMA	Resource Management Act 1991
SH1	State Highway 1
SRS	Site Recording Scheme
Te Tupu Ngātahi	Te Tupu Ngātahi Supporting Growth Alliance
WK	Waka Kotahi New Zealand Transport Agency

1 Executive Summary

Overview

The Warkworth Assessment Package is a network of planned transport infrastructure with the purpose of responding to planned future growth in the Warkworth growth areas. The Warkworth Package is made of eight NORs including new corridors, existing road upgrades, and a public transport interchange with park and ride.

Table 1. Warkworth Assessment Package – NOR and Project Overview

Notice	Project
NOR 1	**Northern Public Transport Hub and Western Link - North**
NOR 2	**Woodcocks Road – West Upgrade**
NOR 3	**State Highway 1 – South Upgrade**
NOR 4	**Matakana Road Upgrade**
NOR 5	**Sandspit Road Upgrade**
NOR 6	**Western Link - South**
NOR 7	**Sandspit Link**
NOR 8	**Wider Western Link – North**

Methodology

This assessment included desktop research using a variety of resources as well as a field assessment. The field assessment was undertaken by Hayley Glover of CFG Heritage Ltd on 13 December and was a pedestrian survey largely limited to publicly accessible areas. It was a surface assessment only; invasive techniques like probing or test pitting were not used due to the high likelihood of services being present near the road.

1.1.1 Assessment of effects

1.1.1.1 Overall Warkworth Network

Most of the proposed designations pass through relatively undeveloped pastoral land, often crossing or running beside streams. There is potential for unrecorded pre-European Māori or colonial sites to be present within the proposed designations, in addition to those recorded sites which are discussed below.

1.1.1.2 NOR 1 – Northern Public Transport Hub and Western Link - North

The project proposes a new public transport interchange with associated facilities + Park and Ride and a new section of four lane urban arterial with cycle lanes and footpaths on both sides. No specific archaeological risks have been identified in this NOR.

1.1.1.3 NOR 2 - Woodcocks Road – West Upgrade

The project proposes the upgrade of Woodcocks Road to a two lane urban arterial cross-section with cycle lanes and footpaths on both sides of the corridor. Four archaeological sites and two CHI items are recorded within 200 m of the designation boundary. Three of these are outside of the proposed designation or unlikely to be affected by works. These are R09/2243 (Cherry's Hut), R09/2246 (track and ford) and 17006 (WWII Camp).

There is some potential for archaeological or historic material and features from R09/2244 (Cherry's Bridge), R09/2247 (artefacts), and 17004 (WWII Camp) to be affected by works. The archaeological and heritage values of these sites have been assessed, with sites recorded in the NZAA SRS assessed under the HNZPTA and those recorded in the CHI assessed under the AUP, Chapter B5.

1.1.1.4 NOR 3 – State Highway 1 – South Upgrade

The project proposes the upgrade of State Highway 1 (southern section) to a two lane urban arterial cross-section with cycle lanes and footpaths. No specific archaeological risks have been identified in this NOR.

1.1.1.5 NOR 4 – Matakana Road Upgrade

The project proposes the upgrade of Matakana Road to a two lane urban arterial cross-section with cycle lanes and footpaths. One archaeological site is recorded within 200 m of the proposed works with potential for archaeological material from R09/2253 (domestic) to be affected by works. The archaeological and heritage value of this site has been assessed under the HNZPTA.

1.1.1.6 NOR 5 – Sandspit Road Upgrade

The project proposes the upgrade of Sandspit Road to a two lane urban arterial cross-section with cycle lanes and footpaths. One archaeological site is recorded within 200 m of the proposed works but is unlikely to be affected by works (R09/2263). This site may, however, be affected by long term operational effects. As redeposited midden is visible in small scatters within the road reserve, there is also increased potential for unrecorded in situ midden to be encountered during construction.

1.1.1.7 NOR 6 – Western Link - South

The project proposes a new two lane urban arterial cross-section with cycle lanes and footpaths. One archaeological site is recorded within 200 m of the proposed works with potential for archaeological material from R09/2284 (road) to be affected by works. The archaeological and heritage value of this site has been assessed under the HNZPTA.

1.1.1.8 NOR 7 – Sandspit Link

The project proposes a new two lane urban arterial cross-section with cycle lanes and footpaths. No specific archaeological risks have been identified in this NOR.

1.1.1.9 NOR 8 – Wider Western Link - North

The project proposes a new two lane urban arterial cross-section with cycle lanes and footpaths. One heritage site is listed within 200 m of the proposed works but is unlikely to be affected by works (17006).

1.1.1.10 Summary of Effects and Recommendations

Table 2. Summary of Effects and Recommendations

Effect	Recommendation
Overall network – potential for unrecorded archaeological sites to be encountered and damaged during works	Archaeological authority and monitoring
NOR 2 – potential for damage to archaeological sites R09/2244 (Cherry's Bridge) and R09/2247 (artefact find spot) as well as CHI site 17004 (WWII camp) during works	Archaeological authority and monitoring
NOR 4 – potential for damage to archaeological site R09/2253 (domestic) during works	Archaeological authority and monitoring
NOR 5 – potential for damage to archaeological site R09/2263 (dam) from operational effects	Manage through HHMP
NOR 6 – potential for damage to archaeological site R09/2284 (road) during works	Archaeological authority and monitoring

It is recommended that, prior to works starting, an authority to destroy, damage or modify archaeological sites recorded in the NZAA SRS (R09/2244, R09/2247, R09/2253 and R09/2284) and unrecorded archaeological sites and any other archaeological features that may be encountered within the identified works areas be applied for from HNZPT under Section 44 of the HNZPTA. Archaeological monitoring will take place during works around recorded sites (described below) and in high-risk areas identified in an archaeological works plan in order to mitigate the effects of works. Archaeological material and features will be recorded, sampled and analysed as appropriate following standard archaeological best practice.

Post-1900 CHI items (such as 17004) are not protected by the HNZPTA but may be subject to additional Auckland Council requirements. Archaeological monitoring will take place during works around this site in order to mitigate the effects of works. Any heritage material and features will be recorded, sampled and analysed as appropriate following standard archaeological best practice.

1.1.1.11 Conclusion

Across the project area, there is potential for unrecorded archaeological sites to be encountered during construction, particularly in undeveloped paddocks and alongside any streams or waterways. There are also several recorded archaeological and heritage sites within the proposed designations that may be partly damaged by works, including Cherry's Bridge (R09/2244), an artefact find spot (R09/2247), a historic house site (R09/2253), a historic road bench (R09/2284) and a WWII Camp (17004).

Works should be undertaken under an archaeological authority obtained from HNZPT and should be guided by an archaeological works plan. Where risk of encountering archaeology is increased,

archaeological monitoring will take place. Any archaeological material identified will be recorded, sampled, and analysed as appropriate following archaeological best practice.

While there is a risk of damage to archaeological sites, which is a negative effect, an archaeological authority will be obtained ahead of works and relevant works carried out with an archaeologist on site to record and analyse material. This will partially mitigate the negative effects and provide an opportunity to learn more about the history of Warkworth.

2 Introduction

This archaeological assessment has been prepared for the Supporting Growth Alliance (**Te Tupu Ngātahi**), Warkworth Package of Notices of Requirement (NORs) for Auckland Transport (AT) and Waka Kotahi NZ Transport Agency (WK) as requiring authorities under the Resource Management Act 1991 (RMA). The notices are to designate land for future strategic transport corridors as part of Te Tupu Ngātahi to enable the future construction, operation and maintenance of transport infrastructure in the Warkworth area of Auckland.

2.1 Warkworth Growth Area

Warkworth is located at the northernmost extent of the Auckland Region, approximately 60 km from the Auckland city centre, and 30 km north of Orewa. It is identified as a satellite town in the Auckland Unitary Plan: Operative in Part (AUP:OP) and will act as a rural node that serves both the surrounding rural communities as well as connecting to urban Auckland.

The Warkworth growth area will be less than 5 km north-south and east-west and will make a significant contribution to the future growth of Auckland's population. 1000 ha of currently rural land has been rezoned (Future Urban Zone) to support significant business and residential growth. At full build out it is anticipated to provide for approximately 8,200 new dwellings and employment activities that will contribute to 4,600 new jobs across Warkworth. This growth area will be development ready in the stages outlined below:

- **Stage 1** Warkworth North – Business land is already live zoned and remainder to be development ready by 2022.
- **Stage 2** Warkworth South – To be development ready between 2028 – 2032
- **Stage 3** Warkworth Northeast – To be development ready between 2033 – 2037

Furthermore, the Warkworth Structure Plan was adopted by the Council in 2019 and sets out the framework for transforming Warkworth from a rural environment to an urbanised community over the next 15 - 20 years.

It is noted that parts of these areas are experiencing earlier than anticipated growth pressure, with parts of Warkworth South subject to a lodged Private Plan Change, as well as sections of Warkworth Northeast.[1]

The Warkworth Assessment Package will provide route protection for the local arterials, which include walking, cycling and public transport linkages needed to support the expected growth in Warkworth. The Warkworth Package of projects is summarised in Section 2.

This report addresses the archaeological effects of the Warkworth Package (NOR 1 - NOR 8) identified in Figure 1 in section 3.

Refer to the Assessment of Effects on the Environment (AEE) for a more detailed project description.

[1] https://www.aucklandcouncil.govt.nz/have-your-say/have-your-say-notified-resource-consent/Pages/resource-consent-public-notice.aspx?itemId=194&src=Search

2.2 Purpose and scope of this Report

This archaeological assessment forms part of the suite of technical reports prepared to support the assessment of effects (AEE) for the Warkworth Package. Its purpose is to inform the AEE that accompanies the eight Warkworth Network NORs sought by AT and WK.

This report considers the actual and potential effects associated with the construction, operation and maintenance of the Warkworth Package on the existing and likely future environment as it relates to archaeological effects and recommends measures that may be implemented to avoid, remedy and/or mitigate these effects.

The key matters addressed in this report are as follows:

a) Identify and describe the archaeological context of the Warkworth Assessment Package area;
b) Identify and describe the actual and potential archaeological effects of each Project corridor within the Warkworth Assessment Package;
c) Recommend measures as appropriate to avoid, remedy or mitigate actual and potential archaeological effects (including any conditions/management plan required) for each Project corridor within the Warkworth Assessment Package; and
d) Present an overall conclusion of the level of actual and potential effects for each Project corridor within the Warkworth Assessment Package after recommended measures are implemented.

This report should be read alongside the AEE, which contains further details on the history and context of the Warkworth project. The AEE also contains a detailed description of works to be authorised within each NOR, and the typical construction methodologies that will be used to implement this work. These have been reviewed by the author of this report and have been considered as part of this assessment of archaeological effects. As such, they are not repeated here. Where a description of an activity is necessary to understand the potential effects, it has been included in this report for clarity.

2.3 Report Structure

In order to provide a clear assessment of each NOR, this report follows as appropriate, the structure set out in the AEE. That is, the network as a whole as well as the individual corridors and facilities have their own section, and each section contains an assessment of the actual and potential effects. Where appropriate, measures to avoid, remedy or mitigate effects are recommended.

The sections are arranged starting from the overall network, then by project form starting from Public Transport Hubs, then existing road upgrades, and finally new corridors. Table 3 below describes the extent of each corridor, and where the description of effects can be found in this report.

Table 3. Report Structure

Sections	Section number
Description of the Project	3

Sections	Section number
Overview of the methodology used to undertake the assessment and identification of the assessment criteria and any relevant standards or guidelines	4
Identification and description of the existing and likely receiving archaeological environment;	5
Assessment of general archaeological and heritage matters for all Warkworth NORs	6
Assessment of specific archaeological and heritage matters for Warkworth NOR 1	7
Assessment of specific archaeological and heritage matters for Warkworth NOR 2	8
Assessment of specific archaeological and heritage matters for Warkworth NOR 3	9
Assessment of specific archaeological and heritage matters for Warkworth NOR 5	10
Assessment of specific archaeological and heritage matters for Warkworth NOR 6	11
Overall conclusion of the level of potential adverse archaeological effects of the Warkworth Project	12

3 Warkworth Package Overview

The Warkworth package is a network of planned transport infrastructure with the purpose of responding to planned future growth in the Warkworth growth areas. The transport network is made of eight NORs including public transport interchanges, existing road upgrades, and new corridors.

An overview of the Warkworth NOR package is set out in Table 4 and shown in Figure.

Table 4. Warkworth NOR Package

Corridor	NOR	Description	Requiring Authority
Northern Public Transport Hub and Western Link - North	NOR 1	Construction of a public transport hub with associated facilities + park and ride facility (approximately 228 carparks) Construction of a four lane urban arterial cross-section with cycle lanes and footpaths	Auckland Transport
Woodcocks Road – West Upgrade	NOR 2	Upgrade of Woodcocks Road to a two lane urban arterial cross-section with cycle lanes and footpaths	Auckland Transport
State Highway 1 – South Upgrade	NOR 3	Upgrade of State Highway 1 to a two lane urban arterial cross-section with cycle lanes and footpaths	Auckland Transport
Matakana Road Upgrade	NOR 4	Upgrade of Matakana Road to a two lane urban arterial cross-section with cycle lanes and footpaths	Auckland Transport
Sandspit Road Upgrade	NOR 5	Upgrade of Sandspit Road to a two lane urban arterial cross-section with cycle lanes and footpaths	Auckland Transport
Western Link South	NOR 6	Construction of a new two lane urban arterial cross-section with cycle lanes and footpaths	Auckland Transport
Sandspit Link	NOR 7	Construction of a new two lane urban arterial cross-section with cycle lanes and footpaths	Auckland Transport
Wider Western Link - North	NOR 8	Construction of a new two lane urban arterial cross-section with cycle lanes and footpaths	Auckland Transport

Figure 1. Warkworth NOR package Overview

4 Assessment Methodology

4.1 Methodology

The following resources were considered in this assessment:

- All recorded sites in the New Zealand Archaeological Association (NZAA) Site Recording Scheme (SRS) in the general vicinity were accessed from the New Zealand Archaeological Association Site Recording Scheme through ArchSite (https//archsite.org.nz, accessed 10 October 2022) and incorporated into the project specific Geographic Information System (GIS) workspace maintained by CFG Heritage.
- The HNZPT digital library (https://www.heritage.org.nz/protecting-heritage/archaeology/digital-library, accessed 10 October 2022) was searched for records of archaeological investigations in the area.
- The HNZPT List / Rārangi Kōrero (https://www.heritage.org.nz/the-list) was searched 10 October 2022 to see if any listed items were within the proposed NORs.
- Old maps and survey plans held by Land Information New Zealand (LINZ) were accessed on date 2022 using QuickMap software.
- Aerial Photographs held by LINZ (https://data.linz.govt.nz/), Auckland Council (https://geomapspublic.aucklandcouncil.govt.nz/) and Retrolens (https://retrolens.co.nz/) were searched on 07 October 2022.
- Local soil information was searched on the S-Map Online database maintained by Landcare Research (https://smap.landcareresearch.co.nz/) accessed on 12 October 2022.
- Potential vegetation based on soil information was obtained from the Land Resource Information Systems database (https://lris.scinfo.org.nz/) accessed on 14 October 2022.
- The Auckland Council Cultural Heritage Inventory (CHI) (https://chi.net.nz/), the Auckland Council GeoMaps GIS viewer (https://geomapspublic.aucklandcouncil.govt.nz/) and Auckland Unitary Plan Viewer (https://unitaryplanmaps.aucklandcouncil.govt.nz) were accessed on 7 October 2022 and searched for any areas of cultural significance.
- Papers Past online database (https://paperspast.natlib.govt.nz/) was accessed 13 March 2022 for historic newspaper articles;
- The National Library of New Zealand's DigitalNZ website (https://digitalnz.org/) was accessed 10 October 2022 for old drawings, photographs, and plans;
- Several written texts on the history of the area;
- Warkworth Network Technical Specialist AEE briefing pack; and
- A drive by viewing of proposed works areas was undertaken 5 October 2022 alongside other specialists.

A field assessment was undertaken on 13 December 2022 by Hayley Glover of CFG Heritage Ltd. This was a pedestrian survey, though several sections of road were unsafe to walk through and had to be driven through instead. The survey was limited to publicly accessible areas, primarily road reserves, as well as access to one private property (Lot 1 DP 437211). The purpose of this field work was to relocate recorded sites where possible and identify any potential unrecorded sites. It was a surface assessment only, no invasive techniques like probing or test pitting were used due to the high likelihood of services being present.

4.2 Preparation for this Report

Work undertaken for this Report commenced September 2022. In summary, the preparation for this work has included:

- Desktop research of the designations using multiple online and paper resources. These are listed in the methodology section above.
- A site visit / field assessment was undertaken on 13 December 2022 by Hayley Glover of CFG Heritage Ltd.

4.3 Statutory Requirements

4.3.1 Heritage New Zealand Pouhere Taonga Act 2014 (HNZPT Act)

All archaeological sites, whether recorded or not, are protected by the provisions of the Heritage New Zealand Pouhere Taonga Act 2014 (**HNZPT Act**) and may not be destroyed, damaged or modified without an authority issued by Heritage New Zealand Pouhere Taonga (**HNZPT**).

An archaeological site is defined in the HNZPT Act as:

> *(a) any place in New Zealand, including any building or structure (or part of a building or structure), that—*
>
> > *(i) was associated with human activity that occurred before 1900 or is the site of the wreck of any vessel where the wreck occurred before 1900; and*
> >
> > *(ii) provides or may provide, through investigation by archaeological methods, evidence relating to the history of New Zealand; and*
>
> *(b) includes a site for which a declaration is made under section 43(1).*

Any HNZPT Act authorities will be applied for at a later date, after detailed design and before any ground disturbance and construction works.

4.3.2 Resource Management Act 1991

The RMA requires District and Regional Councils to manage the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural well-being and for their health and safety while sustaining the potential of natural and physical resources to meet the reasonably foreseeable needs of future generations. The protection of historic heritage from inappropriate subdivision, use, and development is identified as a matter of national importance (Section 6(f)).

Historic heritage is defined in section 2 of the RMA as

Those natural and physical resources that contribute to an understanding and appreciation of New Zealand's history and cultures, derived from any of the following qualities: archaeological, architectural, cultural, historic, scientific, or technological.

Historic heritage includes:

- *historic sites, structures, places, and areas; and*
- *archaeological sites; and sites of significance to Māori, including wāhi tapu; and*
- *surroundings associated with the natural and physical resources.*

These categories are not mutually exclusive, and some archaeological sites may include above ground structures or may also be places that are of significance to Māori.

4.3.3 Auckland Unitary Plan: Operative in Part

The Auckland Unitary Plan: Operative in Part (**AUP:OP**) contains several applicable provisions regarding historic heritage. In the AUP:OP, archaeological sites are defined in accordance with the definitions outlined in the HNZPT Act.

A scheduled historic heritage place can be an individual feature, or encompass multiple features and/or properties, and may include public land, land covered by water and any body of water. A historic heritage place may include cultural landscapes, buildings, structures, monuments, gardens and plantings, archaeological sites and features, traditional sites, sacred places, townscapes, streetscapes and settlements. The criteria for the identification and scheduling of these places is discussed in chapter B5 2.2 of the AUP:OP.

Additionally, there are heritage provisions in chapters E26 Infrastructure and E11/E12 land disturbance of the AUP:OP.

4.4 Limitations and accuracy of data

Archaeological sites have been recorded since the 1950s and the quality of site information is variable. Sites were initially recorded on 100 yd grid references, which were converted to 100 m grid references as the map data became metricated in the 1980s. This has led to sites potentially only having a 200 m accuracy.

Since the mid-1990s, sites recorded by hand-held GPS are generally located to ± 5 m. To ensure all archaeological sites that could be impacted by works are assessed, a 200 m buffer was placed around the Project area and all sites contained within that buffer were subject to categorical desktop assessment to see if they were likely to be impacted by the proposed extent of works. Any sites within 200 m of the Project which could not be ruled out by this method will be considered as within the Project corridor until able to be proven otherwise.

5 Existing and likely receiving archaeological environment

The projects encompassed in the Warkworth NOR package are likely to be constructed 15-20 years from now. The implementation timeframe for each project will vary and correspond with future land release in the area. Assessing the effects on the environment solely as it exists today (i.e., at the time of assessment) will not provide an accurate reflection of the environment in which some of the effects will be experienced. Accordingly, the assessment of effects considers both the existing environment, and the likely receiving environment in which the effects will likely occur.

The Warkworth NOR package will be constructed and will operate alongside existing urban environments or planned future environments (i.e., what can be built under the existing Auckland Unitary Plan: Operative in Part (AUP:OP) and what is identified in the Warkworth Structure Plan):

1. **Existing environment:** A number of corridors comprising the Warkworth NOR package are partially located within/alongside existing urban areas.

e) Matakana Road Upgrade – residential land uses (single house zone, mixed housing suburban zone, mixed housing urban zone) comprise the western and north-western extents of the corridor.
f) Western Link - South – residential land uses are situated to the north and northwest of the corridor and existing industrial land use on the eastern extent of the corridor.
g) State Highway 1 (Southern Section) – residential land uses are adjacent to the northwest and southeast of the northern extent of the corridor, additionally there are established business land uses to the northeast of the northern extent of the corridor.
h) Woodcocks Road – the eastern extent of the corridor has existing residential land uses to the north and south.

2. **Future environment**: All the corridors in the Warkworth NOR package will partially or wholly be constructed and implemented on land identified for future growth (Future Urban Zone) and as a result are anticipated to change to urban or industrial land uses.

The likelihood and magnitude of land use change regarding the land use planning context has been identified in Table 5 below. This has been used to inform the assumptions made on the likely future environment

Table 5. Likelihood and magnitude of land use change

Existing environment	Current AUP:OP Zoning	Likelihood of Change for the environment[2]	Magnitude of potential change	Likely Receiving Environment[3]
Residential[4]	Residential (Mixed Housing Suburban)	Low	Low	Residential
	Residential (Mixed Housing Urban)	Low	Low	Residential
	Residential (Single House)	Low	Low	Residential
Business	Business (Mixed Use)	Low	Low	Business (Industrial)
	Business (General Business)			Business (General Business)
	Business (Light Industry)	Low	Low	Business (Industrial)
	Business (Local Centre Zone)	Low	Low	Business (Neighbourhood Centre)
Open Space	Open Space – Conservation Zone	Low	Low	Informal Recreation
Greenfield areas	Future Urban Zone	High	High	Urban
Other	Special Purpose – Quarry Zone	Low	Med	Quarry

[2] Based on AUP:OP zoning/policy direction

[3] Based on Warkworth Structure Plan and AUP:OP zoning/policy direction

5.1.1 History and background

Warkworth, on the east coast of North Auckland, sits at the southern extent of the Mahurangi River where it discharges into the Mahurangi Harbour, which in turn feeds into the Hauraki Gulf. The Mahurangi estuary and river run through a landscape dominated by steep hills, valleys and waterways. The estuary itself has diverse environments, with several small bays, intertidal mudflats and subtidal areas, rocky platforms, and sandy beaches (Sinclair et al. 2013: 95). In addition to free-flowing streams, there are also wetlands to the north and west of Warkworth. Historically the inland areas were heavily forested with podocarp and broadleaf forests, including extensive kauri forests (Sinclair et al. 2013: 78).

Geologically Warkworth and the wider Mahurangi catchment are part of the Pakihi supergroup, with low-lying areas immediately surrounding the estuary featuring alluvial and colluvial gravels, sands, mud, and peats, with volcanic pumice and tephra ignimbrite deposits. This rests within a wider Waitemata Group sedimentary geology, with alternating beds of coarse to medium sandstones and fine siltstones and mudstone (Edbrooke 2001: 23, 26. https://data.gns.cri.nz/geology/). The soils within the Warkworth area consist of moderately well-draining alluvial soils along the river and estuary, and clay-rich, poorly draining soils further inland (SMaps).

5.1.2 Pre-European Māori settlement

The name Mahurangi comes from a story of the *Tainui* waka in the Māori ancestral homeland of Hawaiki, and belonged to an older woman whose powers enabled its construction (Farley and Clough 2007). The Tainui explorers of the area then gave the name Mahurangi to a small Island off Waiwera, and its surrounding bay. Later it was applied to the region as a whole. What is now the Mahurangi river was then Waihe (Murdoch 1989; ARC 2005). Mahurangi is part of a wider cultural landscape extending from the Waitematā Harbour in the south, Kaipara Harbour in the west and Te Arai Point in the north, characterised by an interrelated history of migration, occupation and conquest. Settlement patterns were mobile, with movement according to seasonal resource availability in the wider region.

Warkworth and its surrounds provided an abundance of resources, making them ideal areas for pre-European Māori settlement. The Mahurangi River and its associated network of waterways contained freshwater resources, as well as providing transport and communication networks. The Mahurangi estuary and harbour provided marine resources, with both rocky and sandy shores providing a range of shellfish. Marine fish was also plentiful, particularly the much sought-after shark fishing at nearby Matakana (Farley and Clough 2007). Inland, the forests provided birds for hunting, and kauri and totara for waka construction (Murdoch 1989). Pre-European Māori horticulture was also practiced in some areas, with warm, north facing sandy soils along the coasts suitable for kūmara cultivation, and wetlands for taro cultivation (Murdoch 1989).

This occupation sequence of Mahurangi is drawn largely from Murdoch (1989, 1992). The wider area of Mahurangi was initially settled by Ngāi Tāhuhu, with later movement in by Tainui/Arawa peoples from the Waitematā Harbour. Intermarrying with the previous peoples, by 16th century they were known as Ngāoho, occupying the area between the Waikato River and Kaipara harbour entrance, including Mahurangi (Murdoch 1989, 1992; Farley and Clough 2007). In the late 1600s Ngā Ririki, now Ngāti Whatua, migrated south from Hokianga to north Kaipara, led by Haumeowharangi (Murdoch 1989). The seven children of Haumoewharangi settled throughout the Kaipara area and they became the founding ancestors of the hapu groups that occupy the Kaipara district today (Murdoch 1989, 1992). As the influence of Ngāti Whātua grew in the southern Kaipara throughout the

early 18th century the name Te Kawerau was used less often and the name Ngāti Rongo became more commonly used (Murdoch 1989, 1992).

The abundance of resources in the area, including the fertile soils, forests, hot water springs at Waiwera, and the coveted shark fishing areas at the mouth of the Matakana River in Mahurangi, attracted the attention of other tribal groups throughout the region. Fighting between the Marutuahu tribes and the Kawerau people of Mahurangi began in the 1720s and continued throughout the 18th century, with at least one major battle taking place at Waiwera (Murdoch 1989). Land was not what was sought in Mahurangi, but rather the 'tauranga ika' or fishing grounds where thousands of sharks could be caught and dried in summer, and then taken home across the Hauraki Gulf to provide a valuable winter food source.

A peace-making meeting was called between the two tribal groups in the vicinity of Kakaha Pā on Maungatauhoro. However, this agreement disintegrated quickly and warfare between the two groups continued until the 1790s. In the 1820s Kawerau found themselves on the receiving end of a musket armed Ngāpuhi war party but Ngāpuhi were defeated at a battle at Mahurangi in 1820, where the Ngāpuhi leader Koriwhai was killed. In 1822 Ngāpuhi sought to avenge the death of Koriwhai. They attacked Kawerau at Te Kohuroa (Matheson's Bay) and after an initial setback emerged victorious (Murdoch 1992). In 1825 a large and important battle was fought in Auckland between Ngāti Whātua and the musket armed Ngāpuhi. Losses were considerable and the Mahurangi area was largely abandoned after the 1825 battle at Te Ika a Ranganui, but Māori began to return to the area from 1836.

5.1.3 Historic settlement

European influence was felt in the area from the 1820s with the arrival of the missionaries, including Reverend Henry Williams and Fairburn Shepherd of the Church Missionary Society (CMS) (Farley and Clough 2007). Under this influence, many Mahurangi Māori converted to Christianity by the 1840s (Morewood 1975).

The first Europeans to settle the area were sawyers, drawn by Mahurangi's kauri forests. Gordon Davis Browne and Captain Ranulph Dacre operated a spar station as timber traders in the Mahurangi, on the Pukapuka Peninsula by 1832 (Goldsmith 2003: 26). Browne had purchased the rights to cut timber from Hauraki Māori, several of whom were employed at the station (Farley 2007). When missionary Henry Williams visited the area in April 1833 he noted around 30 Māori and Pakeha workers (Goldsmith 2003: 26). Williams also wrote of the importance of school sharks as a resource (Roger 1961: 305). Browne's operation ended in 1834 with the arrival of convict ship HMS *Buffalo* and Captain Sadler (Goldsmith 2003: 27). Captain Sadler had permission from the Ngāpuhi chief Titore to harvest timber for the navy and took over both the operation and the workers (Farley 2007). The Buffalo had, according to Browne, 'spoiled' their workforce with their high payment, causing the Browne operation to move to the Coromandel in 1835 / 1836 (Goldsmith 2003: 27). Kauri logging continued as a key industry in Mahurangi until the 1930s, with many subsequent industries based on its timber. Mahurangi's first sawmill, known as 'Brown's Mill,' along with a dam and water-race, was established in 1844 by John Brown in what would become Warkworth, just as Mahurangi was transitioning from a timber camp to a more permanent settlement (ARC 2005; Keys 1954: 33).

In 1840 Surveyor General Felton Mathew, seeking a site for Hobson's new capital, thought Mahurangi Harbour 'admirably adapted for the site of a town', and in April 1841 negotiations for the Mahurangi purchase had begun (Goldsmith 2003: 27). The land from Te Arai Point, north of Warkworth, to Devonport in the south, over 1000 km^2, was sold by Ngāti Paoa to the crown in 1841. This sale,

however, was negotiated with the resident Hauraki peoples only, without consultation of Ngāti Raupo, Ngāti Rongo and Ngāti Manuhiri, in what Goldsmith calls a “hastily arranged and poorly documented” deal (Goldsmith 2003: 27; Murdoch 1991: 7). In 1853 John Anderson Brown, of Brown’s Mill, would purchase 153 acres from the Crown, establishing a small township named Warkworth for his home in Northumberland (Bioletti 1996: 5; Farley and Clough 2007).

The ample timber provided by inland forests led to a local shipbuilding industry in Mahurangi from 1849. The first ship was launched from a small bay south of Cowans Creek in 1852, with at least 74 further vessels being built in the area by 1880 (Farley and Clough 2007) (ARC 2005). In 1852 Thomas Scott Senior purchased land for a shipyard and Inn at the end of the Te Kapa Peninsula. His son would build the Scott Homestead, which still stands (Bailey 2006: 13). Production of quicklime also took place along the Mahurangi River, with lime kilns established by 1850, and Wilsons Cement Works in 1872 (ARC 2005). The hydraulic lime produced in the kilns of Warkworth would be used for mortar and plaster for the local buildings, bridges, farm roads, and to produce Portland Cement (Bioletti 1996: 6). Over time, as the forests around Warkworth were logged away, the surrounding land was converted to farms (ARC 2005).

Figure 2. Photo of Warkworth c. 1890 - 1899. https://digitalnz.org/records/30086951/birds-eye-view-of-warkworth#copyright

Figure 3. View of the Warkworth Wharf from Auckland Weekly News, c. 1890 – 1899. https://digitalnz.org/records/30086952/view-of-the-warkworth-wharf-with-ss-kapanui-at-berth

Figure 4. Lime chute at Warkworth cement works, c. 1910-1920. https://digitalnz.org/records/41746758/lime-chute-at-warkworth-cement-works

5.1.3.1 WWII

During WWII New Zealand served as a staging post for US forces operating in the Pacific. A number of United States military camps were constructed around Auckland, including a brigade camp of 41 small farm encampments, headquarters and a 30-bed hospital at Warkworth (Brassey 2018: 10).

A number of military divisions were stationed around Warkworth, with many memories of their presence recorded in local histories (Canal 2006; Bioletti 1989). The structures in the camps tended to be prefabricated two or four man huts, constructed of native timber, as well as tents with wooden floors and pot-belly stoves (Bioletti 1989:11). After the war, many of the structures continued to be used around Warkworth. Canal (2006) notes that almost every farm in the district had a hut which could be used for calf sheds, hay storage, general sheds and sleeping quarters for workers on the farm. Much of the concrete flooring from the complexes was broken up and reused to make a retaining wall at the school on Hill Street.

5.1.4 Archaeological background

Despite the SRS showing 138 archaeological sites recorded within 5 km of Warkworth's town centre, very little archaeological investigation has been carried out within the project area. A general review shows a pattern of pre-European Māori sites along waterways, particularly the Mahurangi River, Estuary and Harbour, with historic non-Māori sites inland and throughout the township itself. The pre-European Māori sites are predominantly shell midden, oven and terrace sites, while the historic sites tend to be industrial structures such as the lime kilns or dams and historic homes. The uneven

distribution of investigation in the area has led to large gaps in the archaeological record of Warkworth and Mahurangi.

Investigations were undertaken for the subdivision of McKinney Road in 2008, relatively near the NOR 3. This investigation found no evidence of archaeological sites, and noted that the heavy clays of the hill country south of Warkworth were unsuitable for pre-European Māori horticulture (Hooker 2008). The discovery of a cluster of wooden artefacts, kō, in wetlands along Caran Road (near NOR 2) indicates that previously unrecorded pre-European Māori archaeology may still be present in inland areas. Assessments undertaken for Te Ara Tuhono, the Puhoi to Wellsford extension road, which runs to the west of Warkworth intersecting with Carran Road (near NOR 2), found that the US military camps located in that area were the main heritage site, CHI 17005 and CHI 17006.

In 2018 Robert Brassey of Auckland Council undertook surveys of the historic heritage of Warkworth (Brassey 2018). This included site visits and updates on the condition of many of the historic structures in and around Warkworth, though no further archaeological investigation was reported on.

6 Warkworth NORs – Overall network

This section assesses common or general archaeological and heritage matters across the overall Warkworth Project, i.e., the combination of public transport interchanges, existing road upgrades and new corridors. This section also recommends measures to avoid, remedy or mitigate actual or potential adverse effects for the overall network. Corridor-specific matters, where applicable, are further discussed in the following report sections.

6.1 Assessment of construction effects

The proposed designations run through areas of undeveloped pasture where they do not follow existing roads, and cross or run alongside several free-flowing streams. Where specific archaeological sites are recorded and have potential to be impacted by the proposed works, these are discussed separately below. Across the proposed works areas as a whole, there is a risk for unrecorded archaeological sites to be encountered by works and subsequently damaged or destroyed.

The proposed designations were walked over where possible, though in many areas the rural roads were not safe for pedestrian access and needed to be driven through, and visibility in many areas was poor due to dense vegetation around the existing roads. The field assessment was constrained primarily to publicly accessible areas, with one private property accessed in NOR 2. No unrecorded sites were identified during the survey.

The types of subsurface archaeological sites most likely to be encountered when works begin could be pre-European Māori sites, such as middens or artefact finds, or colonial sites such as rubbish pits and glass or ceramic artefacts, or material related to industrial sites like lime works.

6.2 Recommended measures to avoid, remedy or mitigate construction effects

It is recommended that, prior to works starting, an authority to damage or destroy recorded sites (R09/2244, R09/2247, R09/2253, R09/2284), which are discussed in more detail under specific NORs below, and any unrecorded archaeological sites and any other archaeological features that may be encountered within the identified works areas be applied for from HNZPT under Section 44 of the HNZPTA. No authority should be applied for without consultation with the appropriate tangata whenua authorities; evidence of consultation and views expressed will be required by HNZPT and will be taken into account when making a decision about the granting of the authority.

While any unrecorded post-1900 sites are not protected under the HNZPTA, they can still hold historic heritage values. If such a site is encountered during works, the site should be assessed by the archaeologist and investigated in accordance with a historic heritage management plan, as described below. Auckland Council will be notified if any unrecorded post-1900 sites with heritage values are identified.

During works, archaeological / heritage monitoring will take place in higher-risk areas, which will be identified in a historic heritage management plan. If any unrecorded archaeological / heritage material is encountered, it can be recorded, sampled, and analysed as is appropriate in order to mitigate any damage to archaeology/heritage following standard archaeological best practice. Appropriate tikanga (protocols) should be followed during works – mana whenua may make recommendations outlining these.

In the event of kōiwi (human remains) being uncovered during any future construction, work should cease immediately and the appropriate tangata whenua authorities should be contacted so that suitable arrangements can be made. As archaeological survey cannot always detect sites of traditional significance to Māori, or wāhi tapu, the appropriate tangata whenua authorities should be consulted regarding the possible existence of such sites, and the recommendations in this report.

6.3 Assessment of operational effects

No general operational effects have been identified across the Warkworth Project.

6.4 Summary and Conclusions

Most of the proposed designations pass through relatively undeveloped pastoral land where they do not follow existing roads, often crossing or running beside streams. There is potential for unrecorded pre-European Māori or colonial sites to be present within any of the NORs, in addition to those recorded sites which are discussed below. Maps of the project areas and recorded sites are shown below. As seen in Figures 5 and 6, there are known recorded archaeological and heritage sites near NOR 2, NOR 4, NOR 5, NOR 6 and NOR 8, discussed in detail below. There are no known sites in NOR 1, NOR 3 or NOR 7, and they are not discussed further, though there is potential for unrecorded subsurface archaeology to be present.

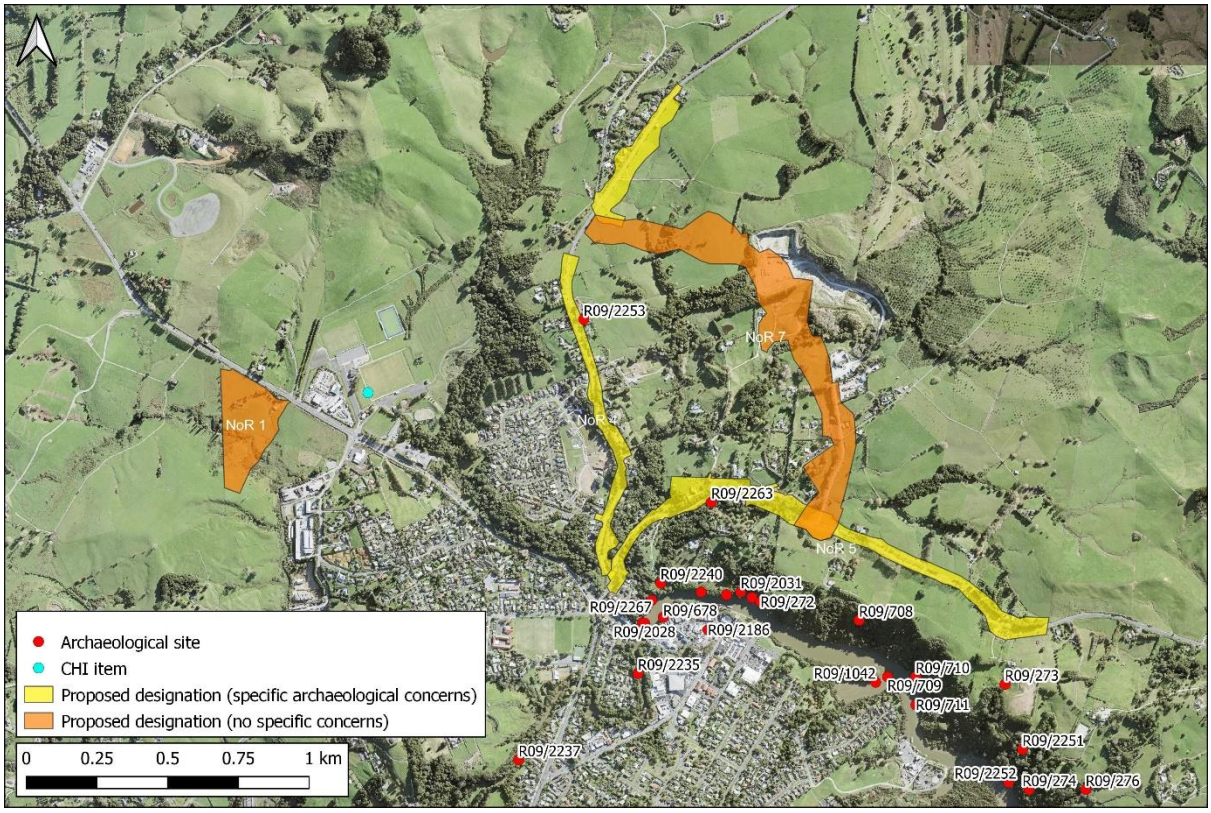

Figure 5. Map of the northern half of the project area showing nearby archaeological sites and those NORs which are discussed in depth below (Proposed designations based on Rev A drawings).

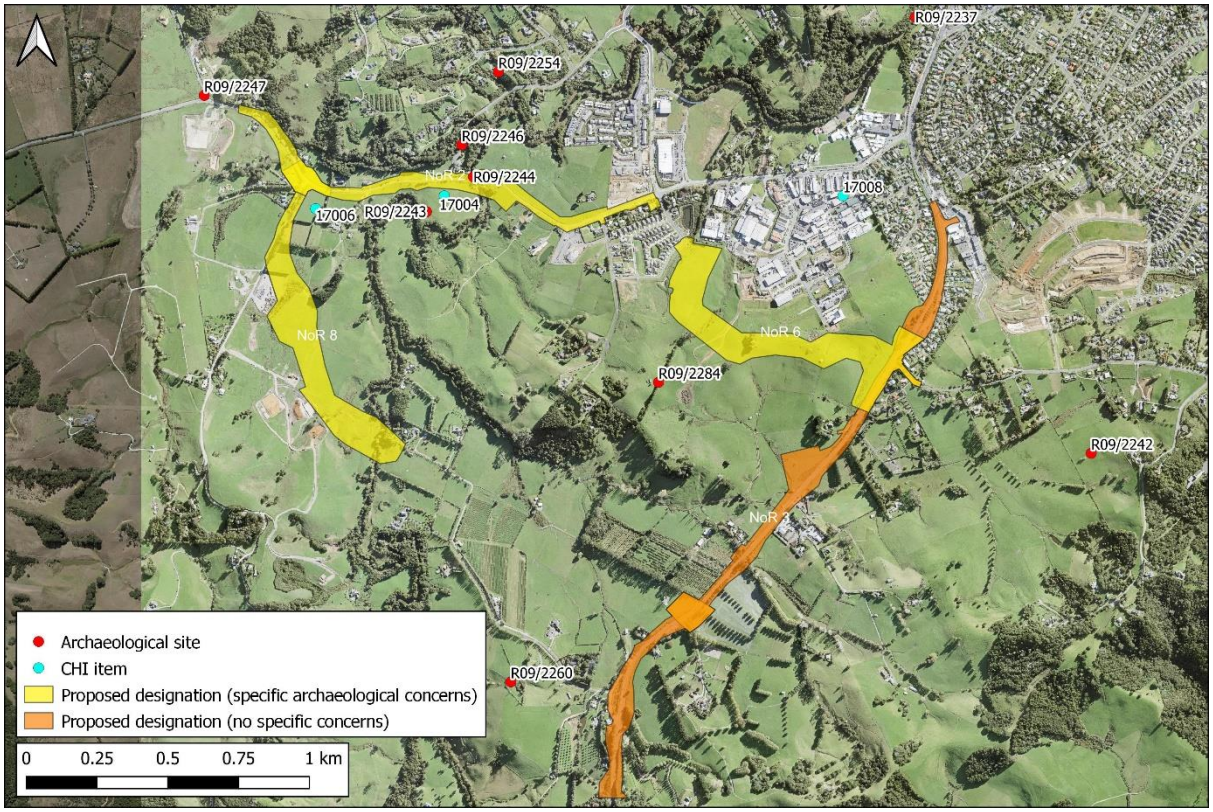

Figure 6. Map of the southern half of the project areas showing nearby archaeological sites and those NORs which are discussed in depth below (Proposed designations based on Rev A drawings).

Table 6. Summary of Assessment of Effects of Recommendations – Overall network

Effect	Assessment	Recommendation
Construction		
Unrecorded sites	Potential damage to sites	Archaeological authority and monitoring
Operational		
No operational effects have been identified	N/A	N/A

7 NOR 2 – Woodcocks Road – West Upgrade

This section assesses specific archaeological and heritage matters relating to NOR 2 – Woodcocks Road.

7.1 Overview and description of works

Refer back to the AEE for a more detailed description of works to be authorised. For the purposes of this report and until detailed earthworks plans are available, it is assumed, unless otherwise described, that anything within the proposed designation has potential for ground disturbance that could impact subsurface archaeological features. The bulk of earthworks will take place within the construction areas set out in Volume 3 of the AEE.

7.2 Assessment Features

Four archaeological sites are recorded in the NZAA SRS within 200 m of the proposed works, as well as two items recorded in the Auckland Council CHI. These sites are described below.

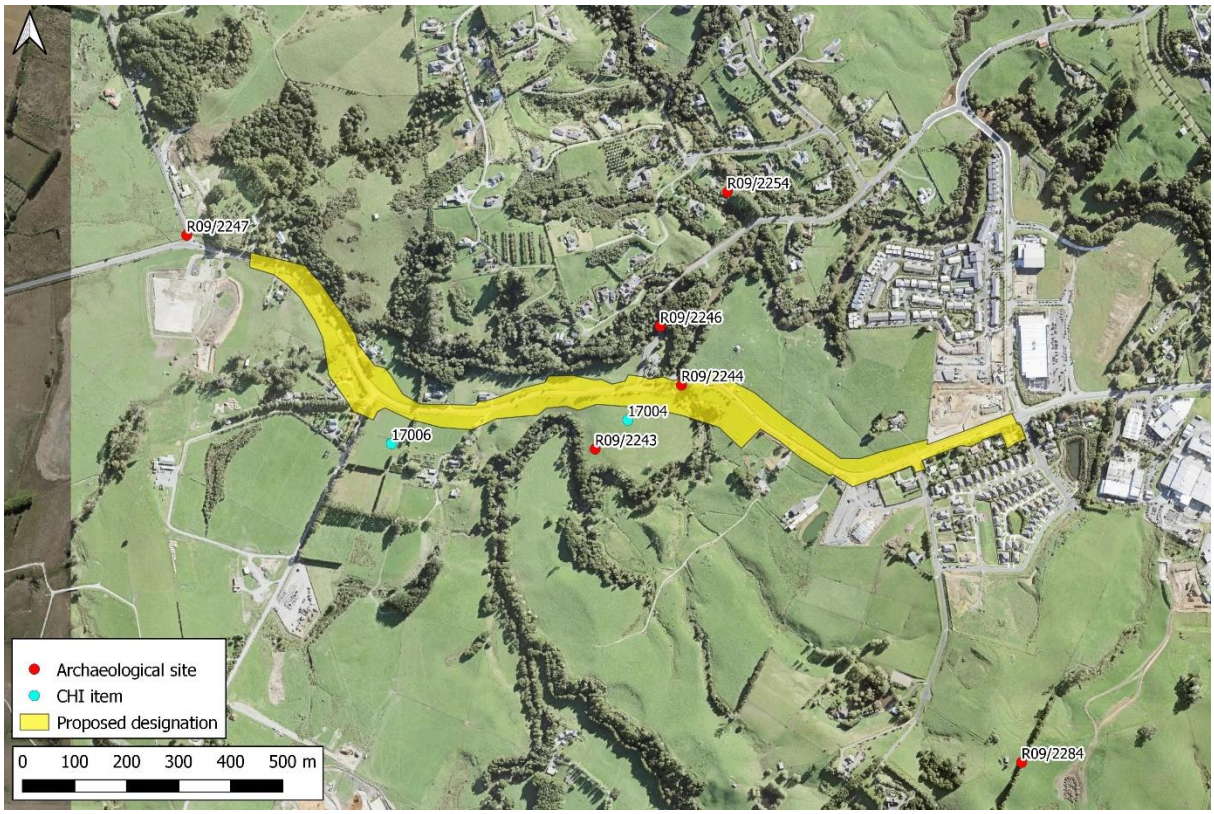

Figure 7. Map of NOR 2, showing nearby archaeological and heritage sites (Proposed designation based on Rev A drawings).

Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the overall Warkworth package.

7.2.1 R09/2243 – Cherry's Hut

This site was recorded by Robert Brassey in 2018 and is the location of landowner and surveyor Francis Cherry's hut, identified from old plans (SO 1150K and SO 891E). Though he owned the

property, he primarily resided in Auckland. Brassey's site visit found no surface evidence of the hut, but he noted that subsurface material was likely present.

This site was walked over during a field assessment for this project. It appears largely unchanged since it was recorded; the paddock remains in pasture and has not been subject to any recent building or earthworks. It is likely that subsurface remains are still present, with the landowner mentioning that they had seen all sorts of glass and ceramic fragments in the ground around their property, though they are unlikely to be within the proposed designation.

Figure 8. View towards Cherry's Hut (R09/2243), no surface remains visible.

7.2.2 R09/2244 – Cherry's Bridge

This site was also recorded by Brassey in 2018. Originally known as Junction Bridge or Trethowen's Bridge, the bridge was renamed Cherry's Bridge after some kind of controversy involving the local landowner Francis Cherry. The original bridge was constructed in 1859, and after being washed away in a flood, a second bridge was rebuilt in 1894. The current bridge is a c.1937 construction. During Brassey's 2018 site visit, no surface evidence of the 19th century structures was visible due to vegetation.

An attempt was made to view this site during the field assessment for this project, but the dense vegetation on the eastern river bank meant there was little to no visibility from that point. The current bridge was not safely accessible on foot, being a one-lane bridge with heavy industrial traffic. The landowner briefly mentioned that he may have seen some evidence of where the original bridge was (immediately south of the current bridge) but he did not provide any further detail or state when this was (the family has owned the property for around 80 years).

There is some potential that piles or other structures from a pre-1900 bridge are still present, obscured by the tide or vegetation, and could be affected by works.

Figure 9. View towards the location of Cherry's Bridge (209/2244), no surface remains visible with the vegetation.

7.2.3 R09/2246 – Track and Ford

This site was recorded by Brassey, who visited the site in 2018. The natural ford over a low waterfall on the left branch of the Mahurangi River was crossed by a historic track to the Puhinui Falls, likely based on an older Māori pathway to the west coast. The road now crossing this ford has evidence of an older gravel road beneath it, and cuttings in a bank north of the crossing. This site is outside of the proposed designation.

7.2.4 R09/2247 – Artefacts

This site was recorded by Rod Clough and Richard Shakles in 2018, during earthworks for construction of the Ara Tuhono. A number of wooden artefacts were encountered in a peat deposit in a former tributary of the Mahurangi River. These included a number of kō (digging sticks), both fragmentary and nearly complete; a pūriri teka (foot piece of a kō); a rātā post with toki markings and; a possible handle of worked Manuka. Shakles notes that these were in a secondary deposition which was likely stream washout, although they may have been part of a cache, as the area is a floodplain suitable for taro horticulture (SRS).

These artefacts have all been removed from the site for conservation, but there is potential for additional subsurface artefact finds to be present nearby, particularly towards the eastern edge of proposed works.

7.2.5 17004 (CHI) – WWII Camp

This item was listed in 2007 by Leah Stevens. It is the site of one of several United States WWII camps around Woodcocks Road. These camps were dismantled following 1944, with many of the structures relocated to other properties in Warkworth. Survey of the area in 2019 noted concrete remains which appeared similar to remains at related camps, including fragments of concrete with water-rolled pebble inclusions, thought to be used within larger structures in the camps such as ablution blocks, kitchens and general foundations (Clough 2019).

This site was walked over during the field assessment for this project and blocks of broken concrete were present across much of the paddock, including directly south of the road, within the extent of the proposed designation. The landowner reported that people fossicking with metal detectors were sometimes present. It is likely that, beyond the concrete blocks, minimal material is present, but there is some potential for material to be present within the proposed designation.

7.2.6 17006 (CHI) – WWII Camp

This item was also listed by Stevens in 2007. It is another United States WWII camp, one of several which were located around Woodcocks Road. These camps were dismantled following 1944, with many of the structures relocated to other properties in Warkworth. Survey of the area in 2019 noted concrete remains which appeared similar to remains at related camps, including fragments of concrete with water-rolled pebble inclusions, thought to be used within larger structures in the camps such as ablution blocks, kitchens and general foundations (Clough 2019).

This site was briefly viewed from the roadside during the field assessment for this project. No evidence related to the camp was visible. There are unlikely to be any effects on this site based on the extent of the proposed designation and condition of the site.

7.3 Assessment of construction effects

Of the four archaeological sites and two CHI items within 200 m of the proposed works, two are outside of the proposed designation. These are R09/2243 (Cherry's Hut), and R09/2246 (track and ford). 17006 (WWII Camp) is likely partially within the proposed NOR but it is unlikely to have any in situ remains present that could be affected by works.

There is some potential for archaeological or historic material and features from R09/2244 (Cherry's Bridge), R09/2247 (artefacts), and 17004 (WWII Camp) to be affected by works. These sites are assessed below, with sites recorded in the SRS assessed under the HNZPTA and those recorded in the CHI assessed under the AUP, Chapter B5. The following assessments of values and significance relate only to archaeological values. Other interested parties, in particular mana whenua, may hold different values regarding the sites.

7.3.1 Assessment under the HNZPTA

The following assessments of archaeological values are based on the criteria set out in the HNZPTA (2019).

7.3.1.1 R09/2244 – Cherry's Bridge

Condition	The pre-1900 bridges have both been destroyed, but remnants of piles or cuttings in the river bank may still be present.

Rarity	Remains of pre-1900 bridges are not common.
Context	This site has relatively high context value in terms of its relation to the rest of Cherry's properties and land use, and the early European settlement / colonisation of Warkworth.
Information	This site could provide some information on the construction materials and methodologies used in bridge construction and design in the mid to late 1800s.
Amenity	The site is not currently accessible by the general public.
Cultural	This is a colonial period site.

7.3.1.2 R09/2247 – Artefacts

Condition	The known material from this site has been removed but additional deposits of artefacts may be present in the surrounding area.
Rarity	Intact wooden artefacts are not common regionally or nationally.
Context	This site has high contextual values as an indicator of pre-European Māori land use, as it relates to the wider archaeological context in the area and can be used as an indicator of where larger scale archaeological landscapes may exist in an under-recorded area.
Information	This site has potential to inform on pre-European Māori tool construction and use, horticulture and land use.
Amenity	The site is not accessible by the general public.
Cultural	This is a pre-European Māori site.

7.3.2 Assessment under AUP Chapter B5

The following assessment of values follows the Auckland Council Methodology for Evaluating Historic Heritage Significance (2019).

7.3.2.1 17004 – WWII Camp

Historical	The site is part of New Zealand and United States history during WWII. This site has moderate historical value.
Social	This site is not visible to the general public and has no social value.
Mana whenua	Only mana whenua can comment on the value of the site to them.
Knowledge	There is very limited physical evidence remaining on the surface, and likely only small amounts of material remaining subsurface. A little information regarding the use of the camp and materials used for construction may be able to be gained. The site has low knowledge value.
Technology	There is unlikely to be any unique or innovative technological attributes remaining at this site. This site has no technology value.

Physical	There is unlikely to be any notable or representative elements of style and construction remaining at this site. This site has no physical value.
Aesthetic	There is very limited surface remains at this site and what remains is broken and obscured by grass. This site has no aesthetic value.
Context	This site has contextual value in terms of its place within the other WWII com. This site has moderate contextual value.

This site has moderate values based on its highest values, which are its historical and context values. Retention of these values is desirable but it does not warrant any special protections and any loss of heritage values can be mitigated by archaeological monitoring and the recording, sampling, analysis, and reporting of any materials or features encountered.

7.4 Recommended measures to avoid, remedy or mitigate construction effects

Recommended measures to mitigate construction effects are outlined in Section 6.

7.5 Summary and Conclusions

The proposed works have potential to damage two archaeological sites recorded in the NZAA SRS R09/2244 and R09/2247) and one site scheduled in the Auckland Council CHI (17004). An archaeological authority will need to be obtained from HNZPT to modify any pre-1900 sites (R09/2244 and R09/2247) and works near these sites will need to be monitored to record any archaeological material that may be impacted by works.

Table 7. Summary of Assessment of Effects and Recommendations – Woodcocks Road upgrade

Effect	Assessment	Recommendation
Construction		
R09/2244	Potential damage to site	Archaeological authority and monitoring
R09/2247	Potential for additional artefacts to be found and removed	Archaeological authority and monitoring
17004 (CHI)	Potential damage to site	Archaeological monitoring

8 NOR 4 – Matakana Road Upgrade

This section assesses specific archaeological and heritage matters relating to NOR 4 – Matakana Road.

8.1 Overview and description of works

Refer back to the AEE for a more detailed description of works to be authorised. For the purposes of this report and until detailed earthworks plans are available, it is assumed, unless otherwise described, that anything within the proposed designation has potential for ground disturbance that could impact subsurface archaeological features. The bulk of earthworks will take place within the construction areas set out in Volume 3 of the AEE.

8.2 Assessment Features

Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the overall Warkworth package. One archaeological site is recorded within 200 m of the proposed works area in the NZAA SRS. This is R09/2253, a historic domestic site. This site is described below.

8.2.1 R09/2253 – House

This site was recorded by Robert Brassey in 2018. It is a timber cottage built by George Young in the mid-1870s at 190 Matakana Road. The site is also recorded in the Auckland Council CHI as 2219. He is thought to have built the home for his daughters, but it is unclear if they or any of the Young family ever lived there. The house is typical of the era and is clad in the original timber boards. In the 1970s, it was restored and altered. A new wrap-around verandah was installed as well as a new lean-to and dormers. An outhouse remaining on the property is early, though the exact date is unknown, and the barn was relocated from another part of the farm to its current location. Five oak trees dating to the late 19th century are present on the property. During Brassey's site visit, the owner said that the stream gully west of the house was a bottle dump but had been well fossicked by bottle collectors.

This property was viewed from the roadside and the carpark entrance during the field assessment for this project. Despite fossicking and significant modification to the grounds (i.e., driveway and landscaping), some historic material may still be present beneath the surface within the scope of the proposed works. The proposed designation does extend into the property and includes a later 20th century garage and ancillary buildings constructed adjacent to the house. The 19th century cottage itself lies immediately outside the proposed designation boundary.

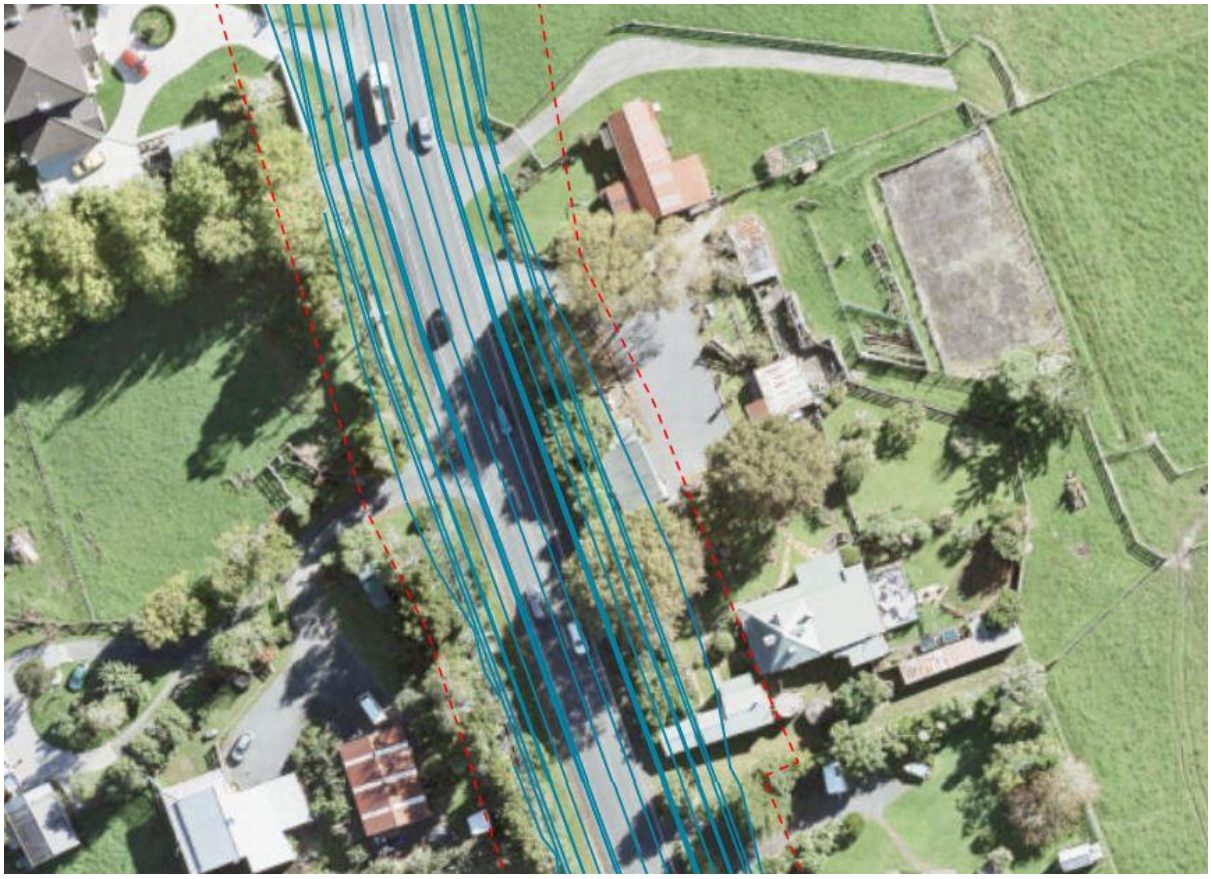

Figure 10. Extent of proposed designation and R09/2253.

Figure 11. View of 19th century cottage from entrance to carpark.

8.3 Assessment of construction effects

There is some potential for subsurface archaeological or historic material from R09/2253 (domestic) to be affected by works. Additionally, construction of the road berm would require removal of the modern (non-archaeological) ancillary buildings and garage (Figure 10**Error! Reference source not found.**). This does not impact on archaeological or other historical values associated with the cottage itself, though there is potential for the removal of the garage and ancillary buildings to result in accidental damage to the cottage. This risk could be actively manged through the HHMP.

This site is assessed below. The following assessment of values and significance relates only to archaeological values. Other interested parties, in particular mana whenua, may hold different values regarding the sites.

8.3.1 Assessment under the HNZPTA

The following assessments of archaeological values are based on the criteria set out in the HNZPTA (2019).

8.3.1.1 R09/2253 – Domestic

Condition	The property has been fossicked but it is likely that some subsurface material remains. The cottage itself is extant with only minor modifications visible.
Rarity	The cottage is an early surviving example of vernacular Mid-Late Victorian architecture, which is not common in the region.
Context	This site has moderate contextual value being part of the early European settlement / colonisation of Warkworth.
Information	This site could provide some information on the use of homesteads and farms at Warkworth in the colonial period and on construction techniques and materials used throughout this time.
Amenity	The site is on private property. There is little opportunity for amenity values to be enhanced in terms of public access, but the cottage is partially visible from the public realm.
Cultural	This is a colonial period site.

8.4 Recommended measures to avoid, remedy or mitigate construction effects

Recommended measures to mitigate construction effects are outlined in Section 6.

8.5 Summary and Conclusions

The proposed works have potential to damage an archaeological site recorded in the NZAA SRS R09/2253). An archaeological authority will need to be obtained from HNZPT to modify any pre-1900 sites (R09/2253) and works near this site will need to be monitored to record any archaeological material that may be impacted by works.

Table 8. Summary of Assessment of Effects and Recommendations – Matakana Road

Effect	Assessment	Recommendation
Construction		
R09/2253	Damage to site and effects on cottage setting	Archaeological authority and monitoring. HHMP to control construction activity in vicinity of cottage, and replacement planting scheme when works completed.

9 NOR 5 – Sandspit Road Upgrade

This section assesses specific archaeological and heritage matters relating to NOR 5 – Sandspit Road.

9.1 Overview and description of works

Refer back to the AEE for a more detailed description of works to be authorised. For the purposes of this report and until detailed earthworks plans are available, it is assumed, unless otherwise described, that anything within the proposed designation has potential for ground disturbance that could impact subsurface archaeological features. The bulk of earthworks will take place within the construction areas set out in Volume 3 of the AEE.

9.2 Assessment Features

Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the overall Warkworth package.

One archaeological site is recorded within 200 m of the proposed works area in the NZAA SRS. This is R09/2263, a dam. This site is described below.

9.2.1 R09/2263 – Wilsons Portland Cement Company Dam

This site was recorded in 2018 by Robert Brassey. It is the likely site of a dam from the later 1870s or early 1880s used for water supply for steamers in Warkworth and is also recorded in the CHI as 21947. The extant dam is a 1913 concrete gravity arch dam. The 1913 dam was reported to be in good condition, viewed from a distance in 2018, but no evidence of the pre-1900 dam was visible. Brassey notes however that poor access and dense vegetation means visibility was poor.

An attempt to view this site was made during the field assessment for this project, but the site was not visible from the road, and access from further downstream was unsuccessful. Brassey (2020) mapped the area of the dam itself and identified an area surrounding the dam that had potential for encountering material related to the historic dam (Figure 12). While the proposed designation does intersect with the edge of this wider area, the proposed works area avoids the physical location of R09/2263. Indirectly, there is potential for upstream changes to influence the flow of water to the dam, which could introduce long-term changes that affect the dam over time.

As part of Plan Change 81, the 1913 Wilson Portland Cement Company Concrete Dam has been proposed for inclusion as a Category B place into Schedule 14.1 of the Auckland Unitary Plan (Brassey 2020). It is recommended for inclusion on the following basis:

Significance Criteria (A-H)	Value	Geographic context
Historical	Moderate	Local
Social	Little / None	N/A
Mana Whenua	N/A	N/A

Significance Criteria (A-H)	Value	Geographic context
Knowledge	Moderate	Local
Technology	Moderate	Regional
Physical	Considerable	Regional
Aesthetic	Little	Local
Context	Considerable	Local

Figure 12. Map of proposed designation and works in relation to extent of R09/2263 as identified by Brassey (2020).

Figure 13. Bank from roadside drops very steeply to the right in this image, dam (R09/2263) is located below in the bush.

Figure 14. Image from Auckland Council Plan Change 81 Historic Heritage Evaluation report: Wilson Portland Cement Company Dam Appendix 2 (Auckland Council 2020) showing downstream face of dam.

9.3 Assessment of construction effects

As works around R09/2263 are confined to the upper bank at the edge of the current Sandspit Road, there are not likely to be any construction effects on this site. However, during the site walkover, several very sparse scatters of highly fragmented redeposited shell were visible beside the current road. These scatters of shell were near the western end of the road. One scatter was immediately east of the Matakana Road junction, with another at the first crossing of a Mahurangi River tributary heading east. This shell was likely redeposited from a midden at some stage during construction of the road or bridge, indicating an increased likelihood that an unrecorded in situ midden could be present within the proposed designation. The approximate location of these scatters are shown in Figure 15 below.

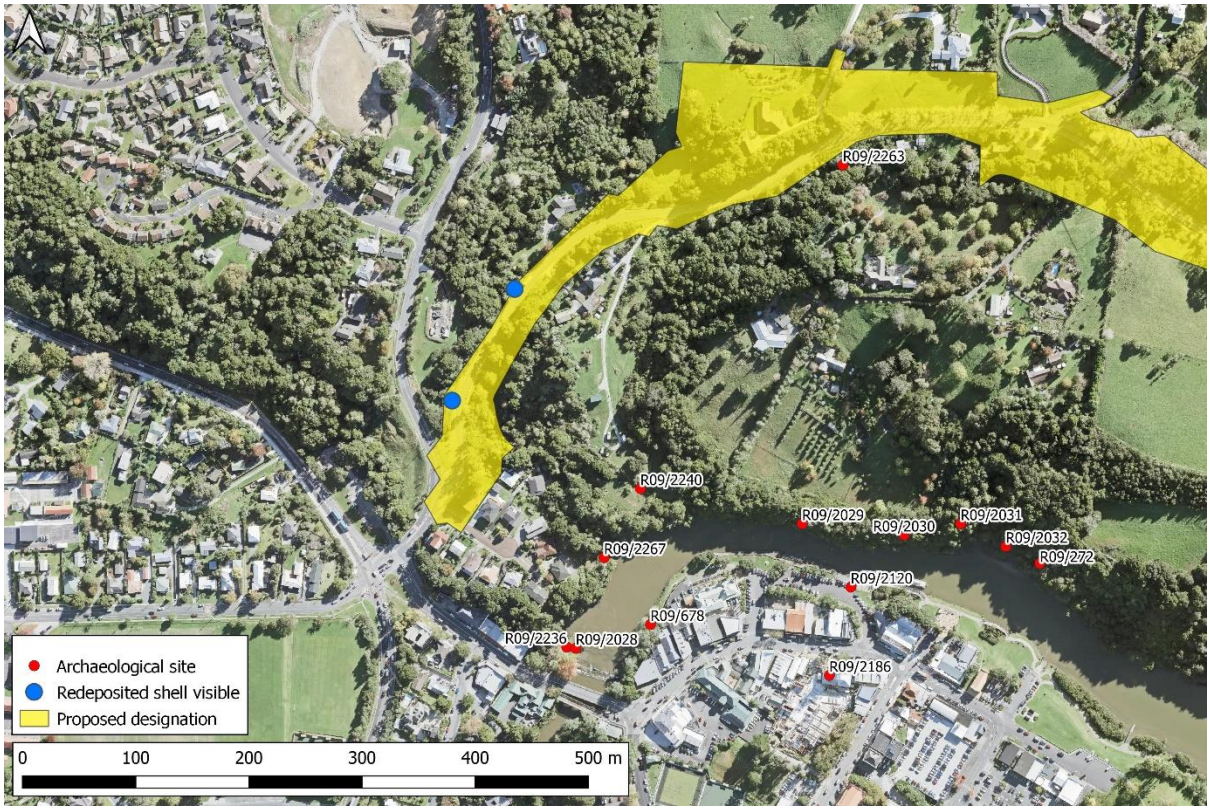

Figure 15. Areas along Sandspit Road where traces of redeposited midden were visible, marked in blue.

Figure 16. Tributary crossed by Sandspit Road beside which small scatters of shell were visible.

9.4 Recommended measures to avoid, remedy or mitigate construction effects

Recommended measures to mitigate construction effects are outlined in Section 6.

9.5 Assessment of operational effects

Upstream works to R09/2263 / CHI 21947 will affect the flow of water and potentially this will influence the effect of water abrasion on the Wilson Portland Cement Company Dam over time. Given the material and solid nature of the dam the potential for cumulative change as a result of operational effects is assessed as limited, when considering that similar weathering effects are already generated in the existing environment. There is potential to manage this change through the provisions of the HHMP. This can include structural assessment of the dam, modelling of upstream design to determine change of flow rates, and design of any requirements to manage those flows further downstream.in the vicinity of the historic dam.

9.6 Summary and Conclusions

There is a recorded archaeological site within 200 m of the proposed works and designation but the current plans indicate that this site will not be impacted by works. There are small scatters of redeposited shell within the proposed designation meaning that in situ midden may be present within the designation as well. An archaeological authority will need to be obtained from HNZPT to modify any potential unrecorded sites (such as potential midden deposits) and works in the areas with increased potential of encountering archaeology will need to be monitored by an archaeologist.

Table 9. Summary of Assessment of Effects and Recommendations – Sandspit Road

Effect	Assessment	Recommendation
Construction		
Potential unrecorded midden.	Potential damage to site.	Archaeological authority and monitoring.
Operational		
R09/2263 – Dam	Potential increased weathering/ water scour on structure over time because of changing water flow	Manage through HHMP, taking structural condition and flow rates into account.

10 NOR 6 – Western Link - South

This section assesses specific archaeological and heritage matters relating to NOR 6 – Western Link South.

10.1 Overview and description of works

Refer back to the AEE for a more detailed description of works to be authorised. For the purposes of this report and until detailed earthworks plans are available, it is assumed, unless otherwise described, that anything within the proposed designation has potential for ground disturbance that could impact subsurface archaeological features. The bulk of earthworks will take place within the construction areas set out in Volume 3 of the AEE.

10.2 Assessment Features

Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the overall Warkworth package. There is one archaeological site recorded in the NZAA SRS within 200 m of the proposed works. This site is described below.

10.2.1 R09/2284 – Road

This site was recorded by Glen Farley and Aaron Apfel in 2021. It is a road bench described on a survey plan from 1855 (SO 1150E), with several sections still visible and being used as farm tracks.

During the field assessment for this project an attempt to view this site from SH1 was made, but the road bench was not visible.

10.3 Assessment of construction effects

Based on LiDAR imagery, parts of R09/2284 (road) are evident within the proposed designation (Figure 17) and will be affected and partially destroyed by works. However, recently consented earthworks associated with the subdivision to the north were undertaken in 2019 and 2020 prior to identification of the site. These have impacted on the remains of the roadway within the property boundary of 25 Gumfield Drive. The site condition was assessed by Plan Heritage Ltd in January 2023 as part of an unrelated subdivision application (Plan Heritage 2023). This included visual assessment, test pitting and probing. The area was found to be modified within the extent of the subdivision earthworks, with surviving elements discernible in the neighbouring property to the east, and further west. Much of the road bench within the proposed designation has been destroyed by these works (Figure 18). The following assessment of values and significance relates only to archaeological values. Other interested parties, in particular mana whenua, may hold different values regarding the sites.

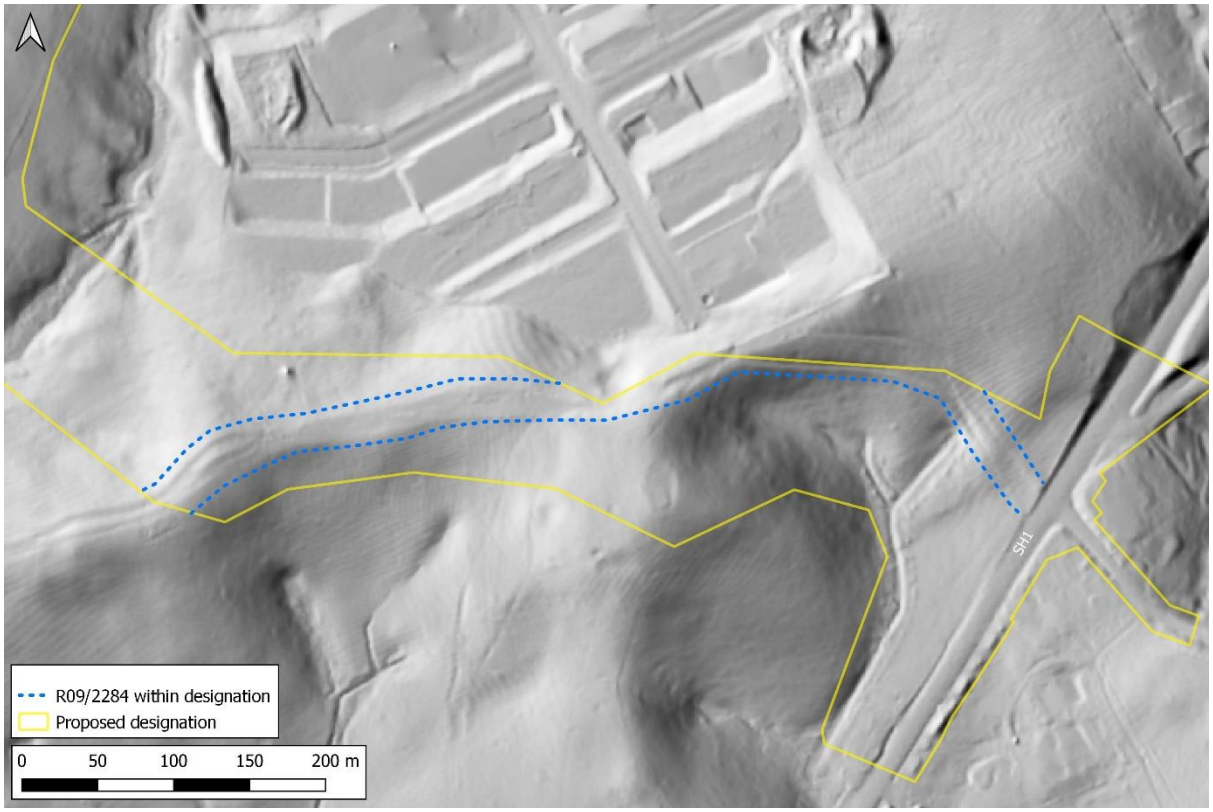

Figure 17. Hillshade derived from LiDAR (2013) showing route of R09/2284 within designation.

Figure 18. Aerial photography (Google Earth, 2019) showing extent of earthworks and R09/2284.

10.3.1 Assessment under the HNZPTA

The following assessments of archaeological values are based on the criteria set out in the HNZPTA (2019).

10.3.1.1 R09/2284 – Road

Condition	While parts of this site have been destroyed by development and roading, segments still remain in reportedly good condition, many now used as farm tracks.
Rarity	Surviving pre-1900 road benches are not commonly seen.
Context	This site has some contextual value being part of the early European settlement / colonisation of Warkworth.
Information	This site could provide some information on the growth and development around Warkworth in the mid to late 1800s.
Amenity	The site is on private property.
Cultural	This is a colonial period site.

10.4 Recommended measures to avoid, remedy or mitigate construction effects

Recommended measures to mitigate construction effects are outlined in Section 6.

10.5 Summary and Conclusions

The proposed works have potential to damage an archaeological site recorded in the NZAA SRS R09/2284). An archaeological authority will need to be obtained from HNZPT to modify any pre-1900 sites (R09/2284) and works near this site will need to be monitored to record any archaeological material that may be impacted by works.

Table 10. Summary of Assessment of Effects and Recommendations Western Link - South

Effect	Assessment	Recommendation
Construction		
R09/2284	Damage to site	Archaeological authority and monitoring

11 NOR 8 – Wider Western Link - North

This section assesses specific archaeological and heritage matters relating to NOR 8 – Wider Western Link.

11.1 Overview and description of works

Refer back to the AEE for a more detailed description of works to be authorised. For the purposes of this report and until detailed earthworks plans are available, it is assumed, unless otherwise described, that anything within the proposed designation has potential for ground disturbance that could impact subsurface archaeological features. The bulk of earthworks will take place within the construction areas set out in Volume 3 of the AEE.

11.2 Assessment Features

Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the overall Warkworth package. One item recorded in the Auckland Council CHI is present within 200 m of the proposed designation. This site is described below.

11.2.1 17006 (CHI) – WWII Camp

This site was recorded by Leah Stevens in 2007. This is one of several United States WWII camps around Woodcocks Road. These camps were dismantled following 1944, with many of the structures relocated to other properties in Warkworth. Survey of the area in 2019 noted concrete remains which appeared similar to remains at related camps, including fragments of concrete with water-rolled pebble inclusions, thought to be used within larger structures in the camps such as ablution blocks, kitchens and general foundations (Clough 2019).

This site was briefly viewed from the roadside during the field assessment for this project. No evidence related to the camp was visible. There are unlikely to be any effects on this site based on the extent of the proposed designation and condition of the site.

11.3 Assessment of construction effects

Works around 17006 are largely confined to the current extent of the road and there are not likely to be any effects on this site.

11.4 Summary and Conclusions

Though there is an item recorded in the Auckland Council CHI within 200 m of the proposed works and designation (17006), the current plans indicate that this site will not be impacted by works. As such, there are no site-specific archaeological effects in addition to those discussed in section 6.

Table 11. Summary of Assessment of Effects and Recommendations Wider Western Link

Effect	Assessment	Recommendation
Construction		
No specific construction effects identified.	N/A	N/A

12 Conclusions

Across the project area, there is potential for unrecorded archaeological and heritage sites to be encountered during construction, particularly in undeveloped paddocks and alongside streams and waterways. There are also several recorded archaeological and heritage sites within the proposed NOR areas that have potential to be partly damaged by works, including Cherry's Bridge (R09/2244), an artefact find spot (R09/2247), a historic house site (R09/2253), a historic road bench (R09/2284) and a WWII Camp (17004). One site may be at risk of damage from operational effects (R09/2263).

All works should be undertaken under an archaeological authority obtained from HNZPT and should be guided by a Historic Heritage Management Plan. Where there is heightened risk of encountering archaeology or post-1900 heritage, archaeological monitoring should take place. Any archaeological or heritage material identified during works will be investigated, recorded, sampled and analysed as relevant, following archaeological best practice.

While there is a risk of damage to archaeological/heritage sites, which is a negative effect, by having an archaeologist on site and available to record and analyse material there will be potential to learn more about the history of Warkworth.

Effect	Assessment	Recommendation
R09/2244 (NOR 2)	Potential damage to archaeological site	Archaeological authority and monitoring
R09/2247 (NOR 2)	Potential damage to archaeological site	Archaeological authority and monitoring
R09/2253 (NOR 4)	Potential damage to archaeological site	Archaeological authority and monitoring
R09/2263 (NOR 5)	Potential long term weathering from upstream changes	Manage through HHMP
R09/2284 (NOR 6)	Potential damage to archaeological site	Archaeological authority and monitoring
17004 (NOR 2)	Potential damage to historic site	Archaeological Monitoring

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ATTACHMENT 63

ASSESSMENT OF CONSTRUCTION NOISE AND VIBRATION EFFECTS

TE TUPU NGĀTAHI
SUPPORTING GROWTH

Warkworth Assessment of Construction Noise and Vibration Effects

May 2023

Version 1.0

Document Status

Responsibility	Name
Author	Dhulkifl Ahmed, Claire Drewery
Reviewer	Siiri Wilkening
Approver	Simon Titter

Revision Status

Version	Date	Reason for Issue
1.0	12/05/2023	Issue of lodgement

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Glossary of Defined Terms and Acronyms

Acronym/Term	Description
AEE	Assessment of Effects on the Environment report
AT	Auckland Transport
AUP:OP	Auckland Unitary Plan: Operative in Part
CEMP	Construction Environmental Management Plan
CNVMP	Construction Noise and Vibration Monitoring Plan
FUZ	Future Urban Zone
HAIL	Hazardous Activities and Industries List
HNZPT / Heritage NZ	Heritage New Zealand Pouhere Taonga
NOR	Notice of Requirement
NOR 1	Northern Public Transport Interchange + Park and Ride and Western Link - North
NOR 2	Woodcocks Road Upgrade (Western Section)
NOR 3	State Highway 1 Upgrade (Southern Section)
NOR 4	Matakana Road Upgrade
NOR 5	Sandspit Road Upgrade
NOR 6	Western Link - South
NOR 7	Sandspit Link
NOR 8	Wider Western Link (Northern Section)
NZ	New Zealand
RMA	Resource Management Act 1991
SH1	State Highway 1
Te Tupu Ngātahi	Te Tupu Ngātahi Supporting Growth Alliance
Waka Kotahi	Waka Kotahi New Zealand Transport Agency
L_{Aeq}	The equivalent continues A-weighted sound pressure level
dB	Unit of measurement of sound

1 Executive Summary

Overview

The Warkworth Assessment Package is a network of planned transport infrastructure with the purpose of responding to planned future growth in the Warkworth growth areas. The transport network is made of eight NoRs including new corridors, existing road upgrades, and a public transport interchange with park and ride.

Table 1-1. Warkworth Assessment Package – NOR and Project Overview

Notice	Project
NOR 1	**Northern Public Transport Interchange + Park and Ride and Western Link - North**
NOR 2	**Woodcocks Road Upgrade (Western Section)**
NOR 3	**State Highway 1 Upgrade – South**
NOR 4	**Matakana Road Upgrade**
NOR 5	**Sandspit Road Upgrade**
NOR 6	**Western Link - South**
NOR 7	**Sandspit Link**
NOR 8	**Wider Western Link – North**

Methodology

Construction noise levels have been assessed using the method recommended in NZS 6803 in accordance with the Auckland Unitary Plan Operative in Part (AUP:OP). As construction of each Project is expected to last for more than 20 weeks, the “long-duration” noise limits are applicable.

Noisy activities will typically be carried out between 7am – 6pm on weekdays. Night-time and weekend works will be limited and only occur for critical activities.

Construction vibration levels have been assessed against the requirements of the AUP:OP, which refer to the criteria in DIN 4150-3:1999 for the avoidance of cosmetic building damage. The AUP:OP also details amenity criteria, which should act as a trigger for consultation if predicted to be exceeded.

Construction noise setback distances and vibration emission radii have been determined (based on assumptions of construction activities and equipment) for each of the NOR sections. The construction boundary was assumed to be the edge of the earthworks boundary. Affected receivers have been identified using construction noise setback distances and vibration emission radii. The construction noise setback distances and vibration emission radii were used to determine where any potential construction noise and vibration exceedances of the relevant criteria could occur. It should also be noted that the emission radii are conservative and vibration levels measured on site tend to be much lower than those predicted at the NOR stage of a project.

Potential effects of construction noise and vibration have then been assessed and construction management and mitigation measures identified where appropriate. To avoid and/or minimise exceedances of the Project construction noise and vibration criteria, Best Practicable Option (BPO) mitigation and management measures should be utilised.

Assessment of effects

NOR 1 – Northern Public Transport Hub and Park and Ride and Western Link North (Northern Section)

The proposed site for the Northern Public Transport Hub is located adjacent to the intersection of State Highway 1 and the proposed new Western Link - North (Northern Section), with few dwellings nearby. The noise environment is dominated by road traffic noise from vehicles using State Highway 1.

Receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 40m from the alignment. With mitigation in place, as set out in Section 7.2, noise levels are predicted to comply with the daytime noise criteria at all existing receivers.

No existing dwellings or commercial structures are predicted to receive vibration levels that exceed the Category B criteria, even if high vibration generating equipment, such as the roller compactor, are used on the construction boundary at the closest position to the receivers.

Where an exceedance is predicted at any receiver that exists at the time of construction, the effects will be mitigated and managed through the Construction Noise and Vibration Management Plan (CNVMP) and Schedules.

NOR 2 – Woodcocks Road Upgrade

Woodcocks Road (western section) runs through a rural and residential environment. The land adjacent to Woodcocks Road is predominantly Future Urban Zone (FUZ) on both sides of the existing corridor with a small area of Residential zoned land to the east of Mason Heights.

Receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 3m away. With mitigation in place, as set out in Section 7.2, noise levels of up to 85 dB L_{Aeq} could occur intermittently at the closest receivers, if high noise generating activities occur on the construction boundary. At this level effects are likely to include loss of concentration, annoyance, and a reduction in speech intelligibility.

Operation of construction equipment will be intermittent in nature. Construction will be linear so as the equipment moves away from the receiver noise levels will reduce. The worst-case situations, where mitigated noise levels could reach 85 dB L_{Aeq} at the closest receivers, are not expected to be frequent, due to the setback distances to the majority of the proposed works and the use of equipment with lower source noise levels for large portions of the works. It is therefore predicted that mitigated noise levels can comply with the 70 dB L_{Aeq} noise criterion for most of the construction works.

Vibration levels could exceed the Category B criteria at one existing dwelling prior to mitigation being implemented, if high vibration generating equipment such as the roller compactor is used on the construction boundary at the closest position to the receiver. Without mitigation, at this receiver there is potential for cosmetic damage to the building (such as cracking) and annoyance from perception of

vibration. Mitigation such as the use of non-vibratory compaction equipment within 8m of buildings is recommended to avoid potential cosmetic damage. Vibration can typically be tolerated inside buildings if it occurs intermittently during the day, is of limited duration and where there is effective prior engagement.

Where an exceedance is predicted at any receiver that exists at the time of construction, the effects will be mitigated and managed through the CNVMP and Schedules.

NOR 3 – State Highway 1

State Highway 1 is an existing busy motorway with commercial buildings and residential dwellings along the road corridor. The noise environment is dominated by road traffic noise from vehicles on State Highway 1.

Receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 3m away. With mitigation in place, as set out in Section 7.2, noise levels of up to 85 dB L_{Aeq} could occur intermittently at the closest receivers, if high noise generating activities occur on the construction boundary. At this level effects are likely to include loss of concentration, annoyance, and a reduction in speech intelligibility.

Operation of construction equipment will be intermittent in nature. Construction will be linear so as the equipment moves away from the receiver noise levels will reduce. The worst-case situations, where mitigated noise levels could reach 85 dB L_{Aeq} at the closest receivers, are not expected to be frequent, due to the setback distances to the majority of the proposed works and the use of equipment with lower source noise levels for large portions of the works. It is therefore predicted that mitigated noise levels can comply with the 70 dB L_{Aeq} noise criterion for most of the construction works.

Vibration levels could exceed the Category B criteria at 12 existing dwellings prior to mitigation being implemented, if high vibration generating equipment such as the roller compactor is used on the construction boundary at the closest position to the receivers. Without mitigation, at these receivers there is potential for cosmetic damage to buildings (such as cracking) and annoyance from perception of vibration. Mitigation such as the use of non-vibratory compaction equipment within 8m of buildings is recommended to avoid potential cosmetic damage. Vibration can typically be tolerated inside buildings if it occurs intermittently during the day, is of limited duration and where there is effective prior engagement.

Where an exceedance is predicted at any receiver that exists at the time of construction, the effects will be mitigated and managed through the CNVMP and Schedules.

NOR 4 – Matakana Road Upgrade

Matakana Road is located within a rural and residential area with some dwellings located close to the road corridor. The noise environment is dominated by road traffic noise from vehicles on Matakana Road.

Receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 3m away. With mitigation in place, as set out in Section 7.2, noise levels of up to 85 dB L_{Aeq} could occur intermittently at the closest receivers, if high noise generating activities occur on the construction boundary. At this level effects are likely to include loss of concentration, annoyance, and a reduction in speech intelligibility.

Operation of construction equipment will be intermittent in nature. Construction will be linear so as the equipment moves away from the receiver noise levels will reduce. The worst-case situations, where mitigated noise levels could reach 85 dB L_{Aeq} at the closest receivers, are not expected to be frequent, due to the setback distances to the majority of the proposed works and the use of equipment with lower source noise levels for large portions of the works. It is therefore predicted that mitigated noise levels can comply with the 70 dB L_{Aeq} noise criterion for most of the construction works.

Vibration levels could exceed the Category B criteria at nine existing dwellings prior to mitigation being implemented, if high vibration generating equipment such as the roller compactor is used on the construction boundary at the closest position to the receivers. Without mitigation, at these receivers there is potential for cosmetic damage to buildings (such as cracking) and annoyance from perception of vibration. Mitigation such as the use of non-vibratory compaction equipment within 8m of buildings is recommended to avoid potential cosmetic damage. Vibration can typically be tolerated inside buildings if it occurs intermittently during the day, is of limited duration and where there is effective prior engagement.

Where an exceedance is predicted at any receiver that exists at the time of construction, the effects will be mitigated and managed through the CNVMP and Schedules.

NOR 5 – Sandspit Road Upgrade

Sandspit Road currently runs through urban and rural environments. In the rural area there are a few dwellings near the road. The noise environment is dominated by road traffic noise from vehicles using the Sandspit Road and the surrounding road network.

Receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 4m away. With mitigation in place, as set out in Section 7.2, noise levels of up to 83 dB L_{Aeq} could occur intermittently at the closest receivers, if high noise generating activities occur on the construction boundary. At this level effects are likely to include loss of concentration, annoyance, and a reduction in speech intelligibility.

Operation of construction equipment will be intermittent in nature. Construction will be linear so as the equipment moves away from the receiver noise levels will reduce. The worst-case situations, where mitigated noise levels could reach 83 dB L_{Aeq} at the closest receivers, are not expected to be frequent, due to the setback distances to the majority of the proposed works and the use of equipment with lower source noise levels for large portions of the works. It is therefore predicted that mitigated noise levels can comply with the 70 dB L_{Aeq} noise criterion for most of the construction works.

Vibration levels could exceed the Category B criteria at one existing dwelling prior to mitigation being implemented, if high vibration generating equipment such as the roller compactor is used on the construction boundary at the closest position to the receiver. Without mitigation, at this receiver there is potential for cosmetic damage to the building (such as cracking) and annoyance from perception of vibration. Mitigation such as the use of non-vibratory compaction equipment within 8m of buildings is recommended to avoid potential cosmetic damage. Vibration can typically be tolerated inside buildings if it occurs intermittently during the day, is of limited duration and where there is effective prior engagement.

Where an exceedance is predicted at any receiver that exists at the time of construction, the effects will be mitigated and managed through the CNVMP and Schedules.

NOR 6 – Western Link - South

Western Link - South is an existing road with commercial and residential buildings along the road corridor. The noise environment is dominated by road traffic noise from vehicles on the nearby road network.

Receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 17m away. With mitigation in place, as set out in Section 7.2, noise levels of up to 72 dB L_{Aeq} could occur intermittently at the closest receivers, if high noise generating activities occur on the construction boundary. At this level effects are likely to include loss of concentration, annoyance, and a reduction in speech intelligibility.

Operation of construction equipment will be intermittent in nature. Construction will be linear so as the equipment moves away from the receiver noise levels will reduce. The worst-case situations, where mitigated noise levels could reach 72 dB L_{Aeq} at the closest receivers, are not expected to be frequent, due to the setback distances to the majority of the proposed works and the use of equipment with lower source noise levels for large portions of the works. It is therefore predicted that mitigated noise levels can comply with the 70 dB L_{Aeq} noise criterion for most of the construction works.

No existing dwellings or commercial structures are predicted to receive vibration levels that exceed the Category B criteria, even if high vibration generating equipment, such as the roller compactor, are used on the construction boundary at the closest position to the receivers.

Where an exceedance is predicted at any receiver that exists at the time of construction, the effects will be mitigated and managed through the CNVMP and Schedules.

NOR 7 – Sandspit Link

The proposed Sandspit Link runs through a currently rural environment. In the rural area there are few dwellings near the road. The noise environment is dominated by road traffic noise from vehicles using the Matakana Road and the surrounding road network.

Receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 15m away. With mitigation in place, as set out in Section 7.2, noise levels of up to 74 dB L_{Aeq} could occur intermittently at the closest receivers, if high noise generating activities occur on the construction boundary. At this level effects are likely to include loss of concentration, annoyance, and a reduction in speech intelligibility.

Operation of construction equipment will be intermittent in nature. Construction will be linear so as the equipment moves away from the receiver noise levels will reduce. The worst-case situations, where mitigated noise levels could reach 74 dB L_{Aeq} at the closest receivers, are not expected to be frequent, due to the setback distances to the majority of the proposed works and the use of equipment with lower source noise levels for large portions of the works. It is therefore predicted that mitigated noise levels can comply with the 70 dB L_{Aeq} noise criterion for most of the construction works.

No existing dwellings or commercial structures are predicted to receive vibration levels that exceed the Category B criteria, even if high vibration generating equipment, such as the roller compactor, are used on the construction boundary at the closest position to the receivers.

Where an exceedance is predicted at any receiver that exists at the time of construction, the effects will be mitigated and managed through the CNVMP and Schedules.

NOR 8 – Wider Western Link – North

The Wider Western Link runs through a predominantly rural area with some residential dwellings located close to the road corridor. The noise environment is dominated by road traffic noise from vehicles on Woodcocks Road.

Receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 10m away. With mitigation in place, as set out in Section 7.2, noise levels of up to 76 dB L_{Aeq} could occur intermittently at the closest receivers, if high noise generating activities occur on the construction boundary. At this level effects likely to include loss of concentration, annoyance, and a reduction in speech intelligibility.

Operation of construction equipment will be intermittent in nature. Construction will be linear so as the equipment moves away from the receiver noise levels will reduce. The worst-case situations, where mitigated noise levels could reach 76 dB L_{Aeq} at the closest receivers, are not expected to be frequent, due to the setback distances to the majority of the proposed works and the use of equipment with lower source noise levels for large portions of the works. It is therefore predicted that mitigated noise levels can comply with the 70 dB L_{Aeq} noise criterion for most of the construction works.

No existing dwellings or commercial structures are predicted to receive vibration levels that exceed the Category B criteria, even if high vibration generating equipment, such as the roller compactor, are used on the construction boundary at the closest position to the receivers.

Where an exceedance is predicted at any receiver that exists at the time of construction, the effects will be mitigated and managed through the CNVMP and Schedules.

2 Introduction

This Construction Noise and Vibration assessment has been prepared for the Te Tupu Ngātahi Supporting Growth Alliance, Warkworth Package of Notices of Requirement (NoRs) for Auckland Transport (AT) and Waka Kotahi NZ Transport Agency (WK) as requiring authorities under the Resource Management Act 1991 (RMA). The notices are to designate land for future strategic transport corridors as part of Te Tupu Ngātahi Supporting Growth Alliance to enable the future construction, operation and maintenance of transport infrastructure in the Warkworth area of Auckland.

2.1 Warkworth Growth Area

Warkworth is located at the northernmost extent of the Auckland Region, approximately 60km from the Auckland city centre, and 30km north of Orewa. It is identified as a satellite town in the Auckland Unitary Plan: Operative in Part (AUP:OP) and will act as a rural node that serves both the surrounding rural communities as well as connecting to urban Auckland.

The Warkworth growth area will be less than 5km north-south and east-west and will make a significant contribution to the future growth of Auckland's population. A 1000ha of currently rural land has been rezoned (FUZ) to support significant business and residential growth. At full build out it is anticipated to provide for approximately 8,200 new dwellings and employment activities that will contribute to 4,600 new jobs across Warkworth. This growth area will be development ready in the stages outlined below:

- **Stage 1** Warkworth North – Business land is already live zoned and remainder to be development ready by 2022.
- **Stage 2** Warkworth South – To be development ready between 2028 – 2032
- **Stage 3** Warkworth Northeast – To be development ready between 2033 – 2037

Furthermore, the Warkworth Structure Plan was adopted by the Council in 2019 and sets out the framework for transforming Warkworth from a rural environment to an urbanised community over the next 15 - 20 years.

It is noted that parts of these areas are experiencing earlier than anticipated growth pressure, with parts of Warkworth South subject to a lodged Private Plan Change, as well as sections of Warkworth Northeast. [1]

The Warkworth Assessment Package will provide route protection for the local arterials, which include walking, cycling and public transport linkages needed to support the expected growth in Warkworth. The Warkworth Package of projects is summarised in Section 3.

This report addresses the construction noise and vibration effects of the Warkworth Package (NOR 1 - NOR 8).

Refer to the Assessment of Effects on the Environment (AEE) for a more detailed project description.

[1] https://www.aucklandcouncil.govt.nz/have-your-say/have-your-say-notified-resource-consent/Pages/resource-consent-public-notice.aspx?itemId=194&src=Search

2.2 Purpose and scope of this Report

This construction noise and vibration assessment forms part of the suite of technical reports prepared to support the AEE for the Warkworth Package. Its purpose is to inform the AEE that accompanies the eight Warkworth Network NORs sought by AT and WK.

This report considers the actual and potential noise effects associated with the construction of the Warkworth Package on the existing and likely future environment as it relates to noise and vibration effects and recommends measures that may be implemented to avoid, remedy and/or mitigate these effects.

The key matters addressed in this report are as follows:

a) Identify and describe the noise and vibration context of the Warkworth Assessment Package area;
b) Identify and describe the actual and potential construction noise and vibration effects of each Project corridor within the Warkworth Assessment Package;
c) Recommend measures as appropriate to avoid, remedy or mitigate actual and potential construction noise and vibration effects (including any conditions/management plan required) for each Project corridor within the Warkworth Assessment Package; and
d) Present an overall conclusion of the level of actual and potential construction noise and vibration effects for each Project corridor within the Warkworth Assessment Package after recommended measures are implemented.

2.3 Report Structure

The report is structured a follows:

a) Overview of the methodology used to undertake the assessment and identification of the assessment criteria and any relevant standards or guidelines;
b) Description of each Project corridor and project features within the Warkworth Assessment Package as it relates to construction noise and vibration;
c) Description of the existing and likely future noise environment;
d) Description of the actual and potential adverse construction noise and vibration effects of construction of each Project;
e) Recommended measures to avoid, remedy or mitigate potential adverse construction noise and vibration effects; and
f) Overall conclusion of the level of potential adverse construction noise and vibration effects of the Project after recommended measures are implemented.

This report should be read alongside the AEE, which contains further details on the history and context of the Warkworth project. The AEE also contains a detailed description of works to be authorised within each NOR, and the typical construction methodologies that will be used to implement this work. These have been reviewed by the author of this report and have been considered as part of this assessment of noise and vibration effects. As such, they are not repeated here. Where a description of an activity is necessary to understand the potential effects, it has been included in this report for clarity.

2.4 Preparation of this Report

The construction methodology and construction drawings for each NOR were reviewed and reference to the AUP:OP, NZS 6803 and DIN 4150 was made (these documents are discussed further below).

A site visit was conducted on 21st February 2023.

Ambient noise measurements were carried out at:

- 153 Woodcocks Avenue
- 10 Georgetti Way
- 171 Matakana Road

3 Warkworth Package Overview

The Warkworth package is a network of planned transport infrastructure with the purpose of responding to planned future growth in the Warkworth growth areas. The transport network is made of eight NoRs including public transport interchanges, existing road upgrades, and new corridors.

An overview of the Warkworth NOR package is set out in Table 3-1 and shown in Figure 3-1.

Table 3-1. Warkworth NOR Package

Corridor	NOR	Description	Requiring Authority
Northern Public Transport Hub and Western Link – North	1	New northern public transport hub and associated facilities including a park and ride at the corner of State Highway 1 (SH1) and the new Western Link – North. New urban arterial cross-section with active mode facilities between the intersection of SH1 and Te Honohono ki Tai (Matakana Link Road) to the proposed bridge crossing, enabling a connection for development in the Warkworth Northern Precinct as provided for in the Warkworth North Precinct.	Auckland Transport
Woodcocks Road - West	2	Upgrade of the existing Woodcocks Road corridor between Mansel Drive and Ara Tūhono (Puhoi to Warkworth) to an urban arterial cross-section with active mode facilities.	Auckland Transport
State Highway 1 – South Upgrade	3	Upgrade of the existing SH1 corridor between Fairwater Road and the southern Rural Urban Boundary to an urban arterial cross-section with active mode facilities.	Auckland Transport
Matakana Road Upgrade	4	Upgrade of the existing Matakana Road corridor between the Hill Street intersection and the northern Rural Urban Boundary to an urban arterial cross-section with active mode facilities.	Auckland Transport
Sandspit Road Upgrade	5	Upgrade of the existing Sandspit Road corridor between the Hill Street intersection and the eastern Rural Urban Boundary to an urban arterial cross-section with active mode facilities.	Auckland Transport

Corridor	NOR	Description	Requiring Authority
Western Link – South	6	New urban arterial cross-section with active mode facilities between the intersection of SH1 and McKinney Road and Evelyn Street.	Auckland Transport
Sandspit Link	7	New urban arterial cross-section with active mode facilities between the intersection of Matakana Road and Te Honohono ki Tai (Matakana Link Road) and Sandspit Road.	Auckland Transport
Wider Western Link – North	8	New urban arterial cross-section with active mode facilities between Woodcocks Road and the Mahurangi River.	Auckland Transport

Figure 3-1. Warkworth NOR package Overview

4 Existing Ambient Noise Environment

In order to establish existing baseline noise levels in the Warkworth area, site surveys were undertaken to measure the existing noise environment.

4.1 Noise Monitoring Procedure

Noise survey equipment, meteorological conditions, data analysis and results are described below. The noise monitoring was undertaken in general accordance with the relevant requirements of NZS 6801, 6802 and 6806. This meant the results could adequately inform both the operational and construction noise assessments.

Measurements were undertaken at the following three locations:

- 153 Woodcocks Avenue
- 10 Georgetti Way
- 171 Matakana Road

These locations were selected to represent an existing environment that is unlikely to change significantly up until the design year, and where road traffic is currently the controlling noise source. The measurement positions were chosen to avoid extraneous factors which could have influenced the sound levels, where practicable. Measurement and calibration details required by NZS 6801 are held on file.

The unattended noise monitoring results can be found in Appendix C. Forms summarising the noise monitoring at each location are provided in Appendix D. Monitoring was undertaken for one week.

4.2 Meteorological Conditions

During the surveys, meteorological data was obtained from Auckland, Warkworth Ews (17838) weather station operated by NIWA. This is the closest station where data was available at an hourly resolution or less.

The meteorological data from this weather station was used to identify periods when conditions were likely to have been outside the meteorological restrictions given in NZS 6801, and therefore data measured during these periods has been excluded from the noise analysis.

4.3 Data Analysis

Road traffic was the dominant noise source at all measurement locations. There is a natural variation in the noise environment throughout the day, and often variations for the weekends. Each day's data was analysed, and abnormal events were excluded. A summary of the measured noise levels at each location for each day is presented in Table 4-1.

The $L_{Aeq(24h)}$ was calculated for each day where there was sufficient data after unsatisfactory meteorological conditions and abnormal events were excluded. This meant that data for the 12th and 13th of February were excluded due to rain.

Note that data was not recorded at 153 Woodcocks Avenue and 171 Matakana Road on the 16th of February since the batteries ran out of power for those sound level meters on that day.

Table 4-1 Summary of measured noise levels

Date	Noise Level, dB $L_{Aeq(24h)}$		
	153 Woodcocks Avenue	10 Georgetti Way	171 Matakana Road
09/02/2023	59	40	49
10/02/2023	59	43	51
11/02/2023	58	50	55
14/02/2023	59	50	57
15/02/2023	58	45	53
16/02/2023	-	43	-

The average $L_{Aeq(24h)}$ for the unattended measurement at each location was:

- 153 Woodcocks Road: 59 dB $L_{Aeq(24h)}$
- 10 Georgetti Way: 47 dB $L_{Aeq(24h)}$
- 171 Matakana Road: 54 dB $L_{Aeq(24h)}$

5 Assessment Criteria

5.1 Construction Noise

The following guidelines and standards have been reviewed for the assessment of construction noise:

- AUP:OP, specifically rule E25.6.27, relating to construction noise in all zones except the City Centre and Metropolitan Centre zones, and E25.6.29 relating to construction noise in the road corridor
- NZS 6803:1999 Acoustics – Construction Noise

Table 5-1 and Table 5-2 below set out the recommended construction noise criteria. These criteria align with the long duration (more than 20 weeks) noise criteria of NZS 6803 and largely reflect the AUP:OP criteria.

Table 5-1 Construction noise criteria for occupied sensitive receivers

Day of the week	Time period	Maximum noise level >20 weeks	
		dB L_{Aeq}	dB L_{Amax}
Weekdays	**6:30 – 7:30**	55	75
	7:30 – 18:00	70	85
	18:00 – 20:00	65	80
	20:00 – 06:30	45	75
Saturdays	**6:30 – 7:30**	45	75
	7:30 – 18:00	70	85
	18:00 – 20:00	45	75
	20:00 – 06:30	45	75
Sunday and public holidays	**6:30 – 7:30**	45	75
	7:30 – 18:00	55	85
	18:00 – 20:00	45	75
	20:00 – 06:30	45	75

Table 5-2 Construction noise criteria for all other occupied receivers

Time period	Maximum noise level >20 weeks dB L_{Aeq}
07:30 – 18:00	70
18:00 – 07:30	75

Exemptions to these levels are provided in Rule E25.6.29 (2) and E25.6.29 (3) where noise levels specified do not apply for planned works in the road between the hours of 10pm and 7am where:

- The number of nights where the noise generated by the works exceeds the relevant noise levels at any one receiver exceeds the relevant noise levels for 3 nights or less; and
- The works cannot practicably be carried out during the day or because the road controlling authority requires this work to be night-time; or
- Because of the nature of the works the noise produced cannot practicably be made to comply with the relevant noise levels.

Under E25.6.29(3) noise levels specified (as replicated above in Table 5-1) do not apply for planned works in the road between the hours of 7am and 10pm where:

- The number of days where the noise generated by the works exceeds the relevant noise levels at any one receiver is 10 days or less; or
- Because of the nature of the works and the proximity of receivers the noise generated cannot be practicably made to comply with the relevant noise levels.

If situations fall under the exemption rules, then a copy of the works access permit issued by Auckland Transport will be provided to the Council five days prior to work commencing; or a construction noise and vibration management plan will be provided to the Council no less than five days prior to the works commencing in accordance with the applicable provisions of Standard E25.6.29(5).

5.2 Construction Vibration

The main objective of controlling construction vibration is to avoid vibration-related damage to buildings, structures, and services, in the vicinity of the works. Any adverse effects of construction vibration on human comfort would typically only be experienced for short durations, for most types of construction work.

It should be noted that the level of vibration perceived by humans, and the level of vibration that is likely to result in annoyance for some people, are magnitudes lower than the level of vibration capable of damaging structures. This means that vibration levels which readily comply with the building damage criteria will likely cause annoyance and adverse reaction from building occupants who mistakenly believe that their building is sustaining damage.

The following guidelines and standards have been reviewed for the assessment of construction vibration:

- AUP:OP rule E25.6.30 relating to construction vibration, amenity and avoidance of any damage to buildings
- German Standard DIN4150-3 (1999) Structural vibration – Part 3 Effects of vibration on structures
- British Standard (BS) 5228-2: 2009 “Code of practice for noise and vibration control on construction and open sites”

Rule E25.6.30 of the AUP:OP relates to construction vibration and contains criteria for both building damage and amenity. The building vibration criteria are based on the German Standard DIN 4150-3:1999 "Structural Vibration - Part 3: Effects of Vibration on Structures". This Standard is conservative and designed to avoid all (including cosmetic) damage to buildings. Significantly higher limits would be applied if damage to structural foundations was the only consideration.

The amenity criteria act as trigger levels for consultation and communication.

Table 5-3 below shows the recommended vibration criteria for all NoRs. These criteria are based on the AUP:OP.

Table 5-3 Construction vibration criteria

Vibration Level	Effect	Category A	Category B
Occupied activities sensitive to noise	Night-time 2000h – 0630	0.3mm/s ppv	2mm/s ppv
	Daytime 0630h – 2000h	2mm/s ppv	5mm/s ppv
Other occupied buildings	Daytime 0630h – 200h.	2mm/s ppv	5mm/s ppv
All other buildings	All other times	Tables 1 and 3 of DIN4150-3:1999	

The two category criteria are to facilitate a progressive management response to the increasing risks and effects during construction.

Category A sets the criteria for the amenity effects where vibrations may be perceived by occupants within a building and is an indicator of when communication and consultations should be initiated to manage effects. The Category A criteria aims to avoid annoyance of building occupants.

If the Category A criteria cannot be practicably achieved, the focus shifts to avoiding building damage rather than avoiding annoyance by applying the Category B criteria. Building damage is unlikely to occur if the Category B criteria are complied with. If predictions indicate that the Category B criteria may be exceeded, building condition surveys must be carried out prior to works commencing and vibration monitoring must be carried out during the works. This allows an assessment of and response to any effects.

6 Assessment Methodology

A consistent approach has been adopted for the whole Warkworth Package as set out in this section. It has been assumed that no concurrent project works will occur across the multiple areas where receivers may be subjected to impacts from more than one designation. Any receivers that may be impacted by more than one Project would be reassessed closer to the time of construction. Buildings within the current proposed designation footprint will be removed, as confirmed by the Project Team, and are not assessed.

Construction noise setback distances and vibration emission radii have been determined based on assumptions of construction activities and equipment for each of the NORs.

The construction boundary is assumed to be the earthworks boundary. Affected receivers have been identified using construction noise setback distances and vibration emission radii. The construction noise setback distances and vibration emission radii were used to determine where any potential construction noise and vibration exceedances of the relevant criteria could occur. Potential effects of construction noise and vibration have then been assessed and construction management and mitigation measures identified where appropriate. Where practicable the, BPO mitigation and management measures should be utilised.

This report proposes a framework for construction noise and vibration management such that the most effective and practicable methods for mitigation will be planned and implemented, taking into account the extent of predicted effects. At the core of this framework is the CNVMP in Section 7.2.1 which will be developed prior to commencement of construction and updated as necessary throughout the duration of construction.

6.1 Construction Methodology

An indicative construction methodology has been provided by the project team to inform the assessment of each of the NoRs.

The outline is based on a generic construction project and has not taken into consideration any project specific scope of works, constraints or staging requirements that may be applicable for each project. The indicative construction programme assumes a linear construction sequence.

The construction methodology for the projects is as follows:

6.1.1 Site establishment

- Site access construction;
- Tree removal and vegetation clearance;
- Remove footpath, streetlights, grass verge berm;
- Property/ building modification or demolition, including fencing, driveways and gates;
- Install environmental controls e.g. silt fencing, sediment retention ponds;
- Implement traffic management to establish the construction zones;
- Service protection works; and
- Construct access tracks/ haul roads (if any).

6.1.2 Advance works

- Relocation of utilities/services; and
- Major earthworks including the following:
    - Ground improvements, undercuts, embankment foundations;
    - Cut and fill works along the alignment to formation level, including preload if required; and
    - Remove preload upon settlement completion, and subgrade preparation.

6.1.3 Main works

- Minor earthworks (cut and fill);
- Remove verge and prepare subgrade formation;
- Construct new longitudinal drainage facilities;
- Construct new pavement, widening works in available areas;
- Move traffic to newly constructed pavement areas and continue with the remaining widening works;
- Pavement reconstruction or reconfiguration of existing road furniture;
- Complete tie in works, footpaths, cycleways, lighting and landscaping;
- Construct permanent stormwater wetlands;
- Construct new culverts including rip rap and headwalls;
- Install road safety barriers (if any); and
- Bridge construction works as follows:
    - Construct abutments;
    - Piling, pier, and headstock construction;
    - Install bridge beams and decking;
    - Install settlement slabs;
    - Retaining wall construction (if any);
    - Accommodation works; and
    - Install signage and lighting.

6.1.4 Finishing works and demobilisation

- Final road surfacing and road markings;
- Commission traffic signals (if any);
- Finishing works e.g. landscaping, street furniture, fencing and outstanding accommodation works;
- Move traffic to the final road configuration; and
- Practical completion and de-establishment.

6.1.5 Plant and Equipment

Table 6-1 provides an indicative list of plant and equipment which may be required for construction across each designation.

Table 6-1 Indicative construction equipment

Construction	Construction Activity
Typical across all works	• Site facility • Light Vehicles • Hiab truck • Trucks
Earthworks	• 20-30T Excavator • Roller Compactor • Water Cart • Tippers • Stabilizers
Drainage	• 20T Excavator • Trench Shields • Tandem Tipper • Loader • Plate compactor • Trucks • Water cart
Pavement Construction	• Grader • Water Cart • Smooth Drum Roller • Vibratory Roller • Tandem Tippers • Kerbing Machine • Concrete Truck • Plate compactor • Paver • Excavators
Bridge construction	• Concrete truck • Excavator • Tip trucks • Cranes • Delivery trucks • Pilling Rig • Concrete Pump • Elevated Work Platform

6.2 Construction Noise

Construction phases for each of the Projects are expected to occur for a minimum of 24 months. Predictions have been assessed against the noise criteria for greater than 20 weeks “long-duration” under NZS6803:1999 as presented in Table 5-1. It is expected that the majority of the works will be carried out between 7am – 6pm Monday to Saturday. There may be extended hours during summer earthworks season (e.g. 6am to 8pm, Monday to Sunday), there is also the possibility of night works for critical activities (culvert construction and road surfacing).

Various construction activities and pieces of equipment will act as noise sources on site during construction works. An indicative construction equipment list has been provided by the project team to assess the noise and vibration effects. Given construction will occur in the future, the current methodology may not be inclusive of all equipment used nearer the time of construction. Equipment tables will need to be updated to reflect selection at the development of the management plan.

A minimum set back distance from receivers to comply with day-time noise criterion of 70 dB L_{Aeq} without mitigation has been calculated.

6.2.1 Equipment Noise Levels

Table 6-2 details the sound power levels from the likely significant noise sources and the various receiver setback distances required to achieve compliance with the 70 dB L_{Aeq} day-time noise criterion without mitigation. The noise data has been taken from British Standard 5228-1:2009 “Code of practice for noise and vibration control on construction and open sites”, manufacturers data or the AECOM database of noise measurements. Equipment selection at detailed design stage may include equipment with different sound power levels than those presented. The equipment list should be reassessed nearer the time at production of the CNVMP.

Table 6-2 Construction Equipment Sound levels and indicative compliance distance

Equipment	Sound power level (dB L_{wA})	Free field noise level at varying distances (dB L_{Aeq})				Minimum Setback distance to comply with day-time criteria without mitigation, metres
		5 m	10 m	20 m	50 m	
30T excavator	105	86	80	73	66	30
20T excavator	99	80	74	67	60	13
Roller compactor	101	82	76	69	62	20
Tipper Truck	107	88	82	75	68	36
Loader	105	86	80	73	66	30
Vibratory Plate Compactor	110	91	85	78	71	45

Equipment	Sound power level (dB L_{wA})	Free field noise level at varying distances (dB L_{Aeq})				Minimum Setback distance to comply with day-time criteria without mitigation, metres
		5 m	10 m	20 m	50 m	
Smooth Drum Roller	103	84	78	71	64	25
Paver	103	84	78	71	64	25
Grader	99	80	74	67	60	13
Bridge Construction Only						
Concrete Truck	107	88	82	75	68	36
Cranes	99	80	74	67	60	13
Concrete Pump	103	81	75	69	61	17
Bored Pilling Rig	111	89	83	77	69	49

Table 6-3 details the sound power levels for key construction activities, combining the equipment sound power levels detailed in Table 6-2 where multiple items of equipment may be operating simultaneously. Table 6-3 also details the minimum setback distance at which compliance can be achieved for each activity.

Table 6-3 Activity Sound Power Levels and Compliance Distance

Construction Type	Activity Sound Power Level (dB L_{wA})	Minimum set back distance from receivers to comply with day-time limit (70 dB L_{Aeq}) without mitigation, metres
Typical across all works	110	48 m
Earthworks	111	49 m
Drainage works	113	55 m
Pavement Construction	115	76 m
Bridge Construction	113	55 m

6.3 Construction Vibration

Vibration generation and propagation is highly site specific. The generation of vibration is dependent on the local site geology, the equipment being used, the nature of the works, and even the operator.

To account for the inaccuracy in the prediction of vibration, the likely worst-case vibration has been calculated based on the equipment and hard ground geology.

Vibration from a source transmits in a spherical pattern and reduces with distance. There will be a particular distance from each source at which the vibration level equals the relevant vibration criteria. This distance is called the 'emission radius'. The vibration criteria and emission radii for high vibration generating equipment are detailed in Table 6-4.

Table 6-4 Vibration sources and indicative emission radii

Equipment	Night-time Occupied Buildings (0.3 mm/s)	Daytime Occupied Buildings (2 mm/s)	DIN 4150 emission radii		
			Historic and Sensitive (2.5 mm/s)	Residential (5 mm/s)	Commercial (10 mm/s)
Roller Compactor	140m	21m	17m	8m	4m
Bored Pilling Rig	17m	4m	2m	1m	1m
Excavator	80m	12m	10m	6m	2m
Tipper Truck	16m	2m	2m	1m	0m
Vibratory Plate Compactor	20m	3m	2m	1m	1m

We recommend that vibration measurements are undertaken at specific locations as identified through the CNVMP and schedules at the commencement of construction activities to establish vibration propagation site laws for vibration generating equipment. This approach will confirm the emission radii used in this assessment and ensure the applicable criteria are complied with. It has been found on other major construction projects, that the measured vibration levels for a particular activity are much lower than those predicted during the assessment stage.

7 Warkworth Construction Effects

7.1 Overview of Construction Effects

Potential construction noise and vibration effects are summarised in this section.

7.1.1 Construction noise

Table 7-1 gives examples of the potential effects on receivers at different noise levels based on NZS6803 with most exposed façades providing a 20 dB reduction. Depending on the construction of the house, facades may provide up to a 25 – 30 dB reduction, therefore assumptions and effects provided below are based on a conservative approach.

Table 7-1 Potential construction noise effects on receivers

External Noise Level	Potential Daytime Effects Outdoors	Corresponding Internal Noise Level	Potential Daytime Effects Indoors
65 dB L_{Aeq}	Conversation becomes strained, particularly over longer distances	45 dB L_{Aeq}	Noise levels would be noticeable but unlikely to interfere with residential or office daily activities.
65 to 70 dB L_{Aeq}	People would not want to spend any length of time outside, except when unavoidable through workplace requirements	45 to 50 dB L_{Aeq}	Concentration would start to be affected. TV and telephone conversations would begin to be affected.
70 to 75 dB L_{Aeq}	Businesses that involve substantial outdoor use (for example garden centres) would experience considerable disruption.	50 to 55 dB L_{Aeq}	Phone conversations would become difficult. Personal conversations would need slightly raised voices. Office work can generally continue, but 55 dB is considered by the experts to be a tipping point for offices. For residential activity, TV and radio sound levels would need to be raised.
75 to 80 dB L_{Aeq}	Some people may choose protection for long periods of exposure. Conversation would be very difficult, even with raised voices.	55 to 60 dB L_{Aeq}	Continuing office work would be extremely difficult and become unproductive. In a residential context, people would actively seek respite.

External Noise Level	Potential Daytime Effects Outdoors	Corresponding Internal Noise Level	Potential Daytime Effects Indoors
80 to 90 dB L_{Aeq}	Hearing protection would be required for prolonged exposure (8 hours at 85 dB) to prevent hearing loss.	60 to 70 dB L_{Aeq}	Untenable for both office and residential environments. Unlikely to be tolerated for any extent of time.

With effective management of construction activities, which includes consultation and communication with affected parties and scheduling noisy works during the daytime rather than night-time period, noise levels can be controlled for each of the Projects so that the effects on the nearest residential receivers are reduced.

Barriers will not be effective at all locations, particularly where receivers are more than one storey. Where barriers are not going to be effective, the use of enclosures or local screening of equipment should be considered and implemented, where practicable.

If noisy activities must take place during the night-time, and screening or other mitigation measures do not provide sufficient attenuation to meet the night-time noise criteria or are not practicable, it may be necessary to offer temporary relocation to affected residents. Temporary relocation should be considered on a case-by-case basis and as a last resort.

7.1.2 Construction vibration

The vibration effects associated with construction of the Projects are considered in terms of human response and building damage. However, in our experience the main concern for building occupants during construction is damage to the building itself.

Humans can generally perceive vibrations at a much lower level than when building damage is likely to occur. The adverse effects of construction vibration on building occupants may be significant in some buildings adjacent to the areas of works. Adverse effects may range from annoyance to loss of amenity or inability to carry out work. Vibration effects will reduce with distance from the source, and the level of vibration transmission into a building will depend on a number of factors, such as the foundation type and building construction.

Potential effects and human perception of the vibration levels found within the AUP:OP and DIN criteria have been combined below and adopted for this assessment.

Table 7-2 Potential vibration effects on human perception summary against AUP:OP/DIN criteria

Vibration level (mm/s PPV)	Potential effects Indoors
0.14 mm/s	The threshold of perception for stationary people. Just perceptible in particularly sensitive environments.
0.3 mm/s	Can be just perceptible during normal residential activities, particularly for more sensitive receivers. Levels above may wake most people from their sleep.

Vibration level (mm/s PPV)	Potential effects Indoors
	This is the AUP:OP limit for construction vibration generated at night-time for sensitive receivers.
1 mm/s	Is typically tolerable with prior notification. Complaint or adverse reaction is likely in office or residential environments, particularly if there is no prior warning. What people actually feel would be subject to the source but could include a steady vibration from sources such as vibratory compaction, or a small jolt such as from the movement of a large digger either of which could rattle crockery and glassware. Sleep disturbance would be almost certain for most people.
2 mm/s	Vibration would clearly be felt. However, it can typically be tolerated in indoor environments such as offices, houses and retail if it occurs intermittently during the day and where there is effective prior engagement. Effects experienced would be somewhere between levels of 1 and 5 mm/s. This is the AUP:OP limit for large construction projects generating vibration.
5 mm/s	Unlikely to be tolerable in a workplace. Highly unsettling for both workplaces and dwellings. If exposure is prolonged, some people may want to leave the building Computer screens would shake and items could fall off shelves if they are not level. This is the threshold below which no cosmetic damage will occur in the DIN standard.
10 mm/s	Likely to be intolerable for anything other than a very brief exposure.

The AUP:OP sets the criteria for amenity at 0.3mm/s for night time and 2 mm/s during the day. Based on the worst-case source of a roller compactor, any receiver within a 21m radius of the construction area may experience vibration of 2 mm/s inside their property. Whilst at this level building damage is highly unlikely to occur, human perception may result in slight concerns but can generally be tolerated if activity occurs intermittently and with prior notice.

At 0.3 mm/s the emission radii could be up to 140m from construction areas, and at this level people could feel slight vibrations especially during the night-time, which may cause sleep disturbance. High vibratory activities should therefore be avoided, where practicable, during the night-time and careful management of the type of equipment used at night should be included within the CNVMP (refer Section 7.2.1).

Construction vibration effects generally have a short timeframe, typically a few days at a time. The use of high vibratory equipment, such as a roller compactor, should be managed through a CNVMP to limit potential vibration effects, and alternative equipment with lower vibratory effect should be used where practicable.

7.2 Recommended Measures to Avoid, Remedy or Mitigate Construction Effects

7.2.1 Construction Noise and Vibration Management Plan

Implementing noise management and mitigation measures via a CNVMP is the most effective way to control construction noise and vibration impacts. The objective of the CNVMP should provide a framework for the development and implementation of best practicable options to avoid, remedy or mitigate the adverse effects on receivers of noise and vibration resulting from construction. Section E25.6.29(5) of the AUP:OP sets out the minimum level of information that must be provided in a CNVMP. Accordingly, as a minimum, we recommend that the CNVMP should include the following content:

- Description of the works and anticipated equipment/processes;
- Hours of operation, including times and days when construction activities would occur;
- The construction noise and vibration standards for the Project;
- Identification of receivers where noise and vibration standards apply;
- Management and mitigation options, including alternative strategies adopting the BPO where full compliance with the relevant noise and/or vibration standards cannot be achieved;
- Methods and frequency for monitoring and reporting on construction noise and vibration, including:
    - Updating the predicted noise and vibration levels based on the final methodology and construction activities;
    - Confirming which buildings will be included in a pre and post building condition survey;
    - Identifying appropriate monitoring locations for receivers of construction noise and vibration;
    - Procedures to respond to complaints received on construction noise and vibration, including methods to monitor and identify noise and vibration sources;
    - Procedure for responding to monitored exceedances; and
    - Procedures for monitoring construction noise and vibration and reporting to the Auckland Council Consent Monitoring officer.
- Procedures for maintaining contact with stakeholders, notifying of proposed construction activities, the period of construction activities, and handling noise and vibration complaints;
- Contact details of the site supervisor or Project manager and the Requiring Authority's Project Liaison Person (phone, postal address, email address);
- Procedures for the regular training of the operators of construction equipment to minimise noise and vibration as well as expected construction site behaviours for all workers;
- Identification of areas where compliance with the noise and/or vibration standards will not be practicable and where a Site Specific Construction Noise and/or Vibration Management Schedule will be required;
- Procedures for how remedial works will be undertaken, should they be required as a result of the building condition surveys; and
- Procedures and timing of reviews of the CNVMP.

7.2.2 Schedules

In addition to a CNVMP, it may be necessary to produce Site Specific or Activity Specific Construction Noise and Vibration Management Schedules ("Schedules") where noise and/or vibration limits are predicted to be exceeded for a more sustained period or by a large margin. A schedule to the CNVMP provides a specific assessment of an activity and/or location and should include details such as:

- Activity location, start and finish dates;
- The nearest neighbours to the activity;
- A location plan;
- Predicted noise/vibration levels and BPO mitigation for the activity and/or location;
- Communication and consultation with the affected neighbours;
- Location, times and type of monitoring; and
- Any pre-condition survey of buildings predicted to receive vibration levels approaching the Category B vibration limits, which document their current condition and any existing damage.

7.2.3 Noise mitigation measures

A hierarchy of mitigation measures will be adopted through the CNVMP and Schedules (where produced), as follows:

- Managing times of activities to avoid night works and other sensitive times;
- Selecting equipment and methodologies to restrict noise;
- Liaising with neighbours so they can work around specific activities;
- Using screening/enclosures/barriers; and
- Offering neighbours temporary relocation.

By following this hierarchy, the BPO for mitigation will be implemented, whilst avoiding undue disruption to the community. In particular, temporary relocation of neighbours can cause significant inconvenience and should only be offered where other options have been exhausted and noise levels still require mitigation.

Some activities are likely to be set back a considerable distance from the nearest receivers and require very little or no mitigation to achieve compliance with the relevant Project noise limits. Alternative methodologies, such as careful equipment selection and use of noise barriers or localised screening (e.g. for concrete cutting) may be suitable management and mitigation measures and should be implemented where they are practicable and effective.

7.2.4 Vibration mitigation

Similarly to noise, a hierarchy of vibration mitigation measures will be adopted through the CNVMP and Schedules (where produced) as follows:

- Managing times of activities to avoid night works and other sensitive times (communicated through community liaison);
- Operating vibration generating equipment as far from sensitive sites as possible;
- Liaising with neighbours so they can work around specific activities;
- Selecting equipment and methodologies to minimise vibration;
- Offering neighbours temporary relocation; and

- In specific situations, a cut-off trench may be used as a vibration barrier if located close to the source.

In general, there are less options available to mitigate vibration propagation and insulate receiver buildings, compared to noise. Mitigation will therefore focus on scheduling of activities, effective communication with neighbours, and selection of appropriate equipment and methods, where practicable.

Appropriate vibration mitigation measures for each activity will be listed in the CNVMP and Schedules (where produced).

7.2.5 Building Condition Survey

A detailed building precondition survey should be undertaken by a suitably qualified engineer prior to the start of construction at all buildings where the daytime Category B criteria may be exceeded. The survey shall include, but not be limited to, the following:

- Determination of building classification: commercial, industrial, residential or a historic or sensitive structure;
- Determination of building specific vibration damage risk thresholds; and
- Recording (including photographs) the major features of the buildings including location, type, construction (including foundation type), age and present condition, including existing levels of any aesthetic damage or structural damage.

A post-construction condition survey of the same buildings shall be conducted when construction is completed, and any damage shown to have been caused by the Project construction rectified by the Project Team.

7.2.6 Night Works

Night works have the potential to cause the greatest disturbance to residents and should be avoided where possible. However, it is possible that night works will be required during the construction period for critical activities. Before night works are programmed, it is important to determine if there are alternative options that would avoid working at night and, if so, whether those options are technically and practicably feasible.

Where there are no practicable alternative options to night works, it may be necessary to implement enhanced noise and vibration management measures, but this will depend on the location of the worksite and the proposed activities.

When work must be carried out at night, it may be necessary to:

- Increase the frequency of communications with stakeholders;
- Carry out regular noise and vibration monitoring to confirm noise and vibration levels; or
- Offer temporary relocation to neighbours if unreasonable noise and/or vibration levels cannot be avoided.

8 NOR 1 – Northern Public Transport Hub and Western Link – North

8.1 Overview and Description of Works

The Northern PT Hub is located adjacent to the intersection of State Highway 1 and the proposed new Western Link - North (Northern Section). This project involves:

- Construction of a PT Hub
- Park and Ride facilities with 228 car park spaces attached to the PT Hub
- Construction of the new Western Link - North, a four-lane urban arterial with cycle lanes and footpaths on both sides

Refer back to the AEE in Volume 2 for a more detailed description of works to be authorised.

8.1.1 Noise Environment

The proposed site for the Northern Public Transport Hub is located adjacent to the intersection of State Highway 1 and the proposed new Western Link - North (Northern Section), with few dwellings nearby. The noise environment is dominated by road traffic noise from vehicles using State Highway 1.

The land adjacent to the proposed Western Link - North (Northern Section) is live zoned as set out in the Warkworth North Precinct Plan. The proposed site for the Northern Public Transport Hub is currently FUZ but will likely be re-zoned to Light Industry or Business Zone. This zoning would likely result in an increase in ambient noise levels.

Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the overall Warkworth package.

8.2 Assessment of Construction Noise and Vibration

8.2.1 Construction Noise Effects

Receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 40m away. High noise generating activities may not occur right on the construction boundary but if they do, one existing property could experience unmitigated noise levels that exceed the daytime noise criterion. Details of all properties where the criteria could be exceeded are provided in Appendix A.

With mitigation in place, as set out in Section 7.2, noise levels are predicted to comply with the daytime noise criteria at all existing receivers.

Future receivers constructed within 76m of the works could experience unmitigated noise levels that exceed the 70 dB L_{Aeq} noise criterion during high noise generating activities such as the pavement works.

Operation of construction equipment will be intermittent in nature. Construction will be linear along the road alignment so as the equipment moves away from the receiver noise levels will reduce.

If a critical activity has to be carried out during the night-time in close proximity to residential receivers, consultation and mitigation measures will be essential. The use of noisy equipment should be avoided where practicable to prevent sleep disturbance. Any night-time works are likely to be limited in duration and will be managed through the CNVMP (as per section 7.2.1) and a Schedule (as per section 7.2.2).

8.2.2 Construction Vibration Effects

Existing receivers near the Northern Public Transport Hub are predominantly residential type structures. No existing buildings are predicted to experience vibration levels above the Category B vibration criteria (5mm/s PPV for residential structures), even if the roller compactor is used on the construction boundary in the closest position to them.

The Category B criterion would be met at future residential structures that are 8m or more from the proposed works and commercial structures that are 4m or more from the proposed works.

No existing receivers are predicted to experience vibration levels above the daytime Category A vibration amenity criteria.

The daytime Category A vibration criteria could be exceeded in future buildings if they are occupied during the works and within 21 m of the roller compactor or within the emission radii identified for the other vibration generating equipment in Table 6-3. The effect on receivers would be subject to their respective proximity to the works but could include steady vibration from the roller compactor or a small jolt from a digger which could rattle crockery and glassware. The Category A criteria should be used as a trigger to initiate consultations with affected parties to manage effects.

Vibration can typically be tolerated inside buildings if it occurs intermittently during the day, is of limited duration and where there is effective prior engagement.

High vibration generating activities should not occur during the night-time in close proximity to residential receivers to avoid sleep disturbance, unless it is a critical activity and there is no alternative.

It should also be noted that the emission radii are conservative and vibration levels measured on site tend to be much lower than those predicted in the early stages of a project.

8.3 Conclusions

The predicted construction noise and vibration levels are based on indicative information to support this NoR, as set out in Section 6, and any conclusions in this assessment should be confirmed during the detailed design stage, taking account of the receivers as they exist at the time of construction.

Construction noise and vibration can be mitigated and managed, utilising the measures set out in Section 7.2, to comply with the applicable limits at existing receivers. Where an exceedance is predicted at any receiver that exists at the time of construction, the effects will be mitigated and managed through the CNVMP and Schedules.

A CNVMP is the most effective way to avoid, remedy or mitigate construction noise and vibration effects on receivers.

9 NOR 2 – Woodcocks Road (Western Section)

9.1 Overview and description of works

Woodcocks Road (western section) is an existing arterial extending from the interchange with Ara Tūhono in the west to the Mansel Drive intersection in the east. It is proposed to upgrade the existing corridor to a two-lane urban arterial with cycling and walking facilities on both sides of the corridor.

The proposed upgrade will provide a key east-west connection for all modes between existing SH1 and the western growth area in Warkworth. Additionally, the corridor connects to key future north-south links including the Wider Western Link Round and Western Link - South. The upgrade will also improve active mode user safety along the corridor.

Refer back to the AEE in Volume 2 for a more detailed description of works to be authorised.

9.1.1 Noise Environment

Woodcocks Road (western section) runs through a rural and residential environment. The land adjacent to Woodcocks Road is predominantly zoned FUZ on both sides of the existing corridor with a small area of Residential zoned land to the east of Mason Heights.

The noise environment is dominated by road traffic noise from vehicles on Woodcocks Road.

The Warkworth Structure Plan indicates that the area surrounding Woodcocks Road is likely to be zoned as Residential. This zoning would likely result in an increase in ambient noise levels as the area urbanises.

9.2 Assessment of Construction Noise and Vibration Effects

9.2.1 Construction Noise Effects

Receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 3m. High noise generating activities may not occur right on the construction boundary but if they do, 25 existing receivers could experience unmitigated noise levels that exceed the daytime noise criterion. Details of all properties where the criteria could be exceeded are provided in Appendix A.

With mitigation in place, as set out in Section 7.2, noise levels of up to 85 dB L_{Aeq} could still occur intermittently at the closest receivers, if high noise generating activities occur on the construction boundary. At this level effects likely to include loss of concentration, annoyance, and a reduction in speech intelligibility. We note that the existing receivers may not be present at the time of construction.

Future receivers constructed within 76m of the works could experience unmitigated noise levels that exceed the 70 dB L_{Aeq} noise criterion during high noise generating activities such as the pavement works.

Operation of construction equipment will be intermittent in nature. Construction will be linear so as the equipment moves away from the receiver noise levels will reduce. The worst-case situations, where mitigated noise levels could reach 85 dB L_{Aeq} at the closest receivers, are not expected to be frequent,

due to the setback distances to the majority of the proposed works and the use of equipment with lower source noise levels for large portions of the works. It is therefore predicted that mitigated noise levels can comply with the 70 dB L_{Aeq} noise criterion for most of the construction works.

If a critical activity has to be carried out during the night-time in close proximity to residential receivers, consultation and mitigation measures will be essential. The use of noisy equipment should be avoided, where practicable, to prevent sleep disturbance. Any night-time works are likely to be limited in duration and will be managed through the CNVMP (as per Section 7.2.1) and a Schedule (as per Section 7.2.2).

9.2.2 Construction Vibration Effects

Existing receivers near Woodcocks Road are predominately residential type structures. One existing dwelling may experience vibration levels above 5mm/s PPV, exceeding the daytime Category B criterion, if the roller compactor is used on the designation boundary in the closest position to the receiver. No commercial receivers are predicted to exceed the 10mm/s PPV daytime criteria. The addresses of receivers where the Category B criteria may be exceeded are listed in Appendix B. Once the compactor is 8m away from the dwellings the Category B criterion will be met. The Category B criteria would be met at future residential structures that are 8m or more from the proposed works and commercial structures that are 4m or more from the proposed works.

Without mitigation, at these receivers there is potential for cosmetic damage to buildings (such as cracking) and annoyance from perception of vibration. Mitigation such as the use of non-vibratory compaction equipment within 8m of buildings is recommended to avoid potential cosmetic damage.

The daytime Category A vibration amenity criteria could be exceeded in existing or future buildings if they are occupied during the works and within 21 m of the roller compactor or within the emission radii identified for the other vibration generating equipment in Table 6-4. The effect on receivers would be subject to their respective proximity to the works but could include steady vibration from the roller compactor or a small jolt from a digger which could rattle crockery and glassware.

Vibration can typically be tolerated inside buildings if it occurs intermittently during the day, is of limited duration and where there is effective prior engagement.

High vibration generating activities should not occur during the night-time in close proximity to residential receivers to avoid sleep disturbance, unless it is a critical activity and there is no alternative.

It should also be noted that the emission radii are conservative and vibration levels measured on site tend to be much lower than those predicted at the NOR stage of a project.

9.3 Conclusions

The predicted construction noise and vibration levels are based on indicative information provided by the Project team, as set out in Section 6, and any conclusions in this assessment should be confirmed during the detailed design stage, taking account of the receivers as they exist at the time of construction.

Construction noise and vibration can be mitigated and managed, utilising the measures set out in Section 7.2, to generally comply with the applicable limits as defined in the AUP:OP. Exceedances of

the criteria could occur intermittently over a short duration if high noise or vibration generating equipment are used near occupied buildings. Where an exceedance is predicted at any receiver that exists at the time of construction, the effects will be mitigated and managed through the CNVMP and Schedules.

A CNVMP is the most effective way to avoid, remedy or mitigate construction noise and vibration effects on receivers.

10 NOR 3 – State Highway 1 Upgrade – South

10.1 Overview and description of works

The section of SH1 within NOR 3 extends from the Northern Gateway Toll Road in the south to its intersection with Auckland Road in the northeast, with the extents of the proposed upgrade from the FUZ boundary in the south to its intersection with Fairwater Road in the north. The SH1 (southern section) upgrade involves the urbanisation of the corridor to a two-lane urban arterial with cycle lanes and footpaths on both sides of the entire corridor length.

The proposed upgrade will provide a key north-south connection through Warkworth and with the provision of dedicated walking and cycling facilities will become the primary north-south active mode corridor in Warkworth.

Refer back to the AEE in Volume 2 for a more detailed description of works to be authorised.

10.1.1 Noise Environment

The land on both sides of the southern section of the alignment is zoned FUZ. The northern section of the alignment is predominantly zoned as Residential – Single House Zone and to the east of the corridor as Business – Local Centre Zone.

State Highway 1 is an existing busy road with commercial buildings and residential dwellings along the road corridor. The noise environment is dominated by road traffic noise from vehicles on State Highway 1.

It is anticipated that the noise environment in the future will change as a result of the opening of Ara Tuhono (Puhoi to Warkworth). When Ara Tuhono opens, SH1 will become an arterial road and it is anticipated that the majority of traffic passing through Warkworth will use the new corridor.

Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the overall Warkworth package.

10.2 Assessment of Construction Noise and Vibration Effects

10.2.1 Construction Noise Effects

Receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 3m from the designation. High noise generating activities may not occur right on the construction boundary but if they do, 91 existing receivers could experience unmitigated noise levels that exceed the daytime noise criterion. Details of all properties where the criteria could be exceeded are provided in Appendix A.

With mitigation in place, as set out in Section 7.2, noise levels of up to 85 dB L_{Aeq} could still occur intermittently at the closest receivers, if high noise generating activities occur on the construction boundary. At this level effects likely to include loss of concentration, annoyance, and a reduction in speech intelligibility. We note that the existing receivers may not be present at the time of construction.

Future receivers constructed within 76m of the works could experience unmitigated noise levels that exceed the 70 dB L_{Aeq} noise criterion during high noise generating activities such as the pavement works.

Operation of construction equipment will be intermittent in nature. Construction will be linear so as the equipment moves away from the receiver noise levels will reduce. The worst-case situations, where mitigated noise levels could reach 85 dB L_{Aeq} at the closest receivers, are not expected to be frequent, due to the setback distances to the majority of the proposed works and the use of equipment with lower source noise levels for large portions of the works. It is therefore predicted that mitigated noise levels can comply with the 70 dB L_{Aeq} noise criterion for most of the construction works.

If a critical activity has to be carried out during the night-time in close proximity to residential receivers, consultation and mitigation measures will be essential. The use of noisy equipment should be avoided, where practicable, to prevent sleep disturbance. Any night-time works are likely to be limited in duration and will be managed through the CNVMP (as per Section 7.2.1) and a Schedule (as per Section 7.2.2).

10.2.2 Construction Vibration Effects

Existing receivers near State Highway 1 are a mix of residential and commercial type structures. 12 existing dwellings may experience vibration levels above 5mm/s PPV, exceeding the Category B criterion, if the roller compactor is used on the construction boundary in the closest position. No commercial receivers are predicted to exceed the 10mm/s PPV daytime criterion. The addresses of receivers where the Category B criteria may be exceeded are listed in Appendix B. Once the compactor is 8m away from the dwellings the Category B criterion will be met. The Category B criteria would be met at future residential structures that are 8m or more from the proposed works and commercial structures that are 4m or more from the proposed works.

Without mitigation, at these receivers there is potential for cosmetic damage to buildings (such as cracking) and annoyance from perception of vibration. Mitigation such as the use of non-vibratory compaction equipment within 8m of buildings is recommended to avoid potential cosmetic damage.

The daytime Category A vibration amenity criteria could be exceeded in existing or future PPFs if they are occupied during the works and within 21 m of the roller compactor or within the emission radii identified for the other vibration generating equipment in Table 6-4. The effect on receivers would be subject to their respective proximity to the works but could include steady vibration from the roller compactor or a small jolt from a digger which could rattle crockery and glassware.

Vibration can typically be tolerated inside buildings if it occurs intermittently during the day, is of limited duration and where there is effective prior engagement.

High vibration generating activities should not occur during the night-time in close proximity to residential receivers to avoid sleep disturbance, unless it is a critical activity and there is no alternative.

It should also be noted that the emission radii are conservative and vibration levels measured on site tend to be much lower than those predicted at the NOR stage of a project.

10.3 Conclusion

The predicted construction noise and vibration levels are based on indicative information provided by the Project team, as set out in Section 6, and any conclusions in this assessment should be confirmed during the detailed design stage, taking account of the receivers as they exist at the time of construction.

Construction noise and vibration can be mitigated and managed, utilising the measures set out in Section 7.2, to generally comply with the applicable limits as defined in the AUP:OP. Exceedances of the criteria could occur intermittently over a short duration if high noise or vibration generating equipment are used near occupied buildings. Where an exceedance is predicted at any receiver that exists at the time of construction, the effects will be mitigated and managed through the CNVMP and Schedules.

A CNVMP is the most effective way to avoid, remedy or mitigate construction noise and vibration effects on receivers.

11 NOR 4 – Matakana Road Upgrade

11.1 Overview and description of works

Matakana Road is an existing arterial connecting the growth area of Warkworth and the towns of Matakana and Omaha. This project extends from the tie in with the Hill Street intersection upgrade project in the south to the FUZ boundary in the north, and it is intersected by the Te Honohono ki Tai (Matakana Link Road) project at its mid-point.

It is proposed to upgrade Matakana Road to a two-lane urban arterial with cycle lanes and footpaths on both sides.

Refer back to the AEE in Volume 2 for a more detailed description of works to be authorised.

11.1.1 Noise Environment

The existing Matakana Road corridor runs through predominantly residential land uses. The eastern extent of Matakana Road is zoned as FUZ. The western and north-western sections of the corridor are comprised of residential land uses (Residential – Single House Zone, Mixed Housing Suburban Zone, and Mixed Housing Urban Zone).

The Warkworth Structure Plan indicates that the FUZ surrounding Matakana Road is likely to be zoned as Residential in the future. This zoning would likely result in an increase in ambient noise levels as the area urbanises.

Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the overall Warkworth package.

11.2 Assessment of Construction Noise and Vibration Effects

11.2.1 Construction Noise Effects

Receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver at 3m. High noise generating activities may not occur right on the construction boundary, but if they do, 53 existing properties could experience unmitigated noise levels that exceed the daytime noise criterion. Details of all properties where the criteria could be exceeded are provided in Appendix A.

With mitigation in place as set out in Section 7.2, noise levels of up to 85 dB L_{Aeq} could still occur intermittently at the closest receivers, if high noise generating activities occur on the construction boundary. At this level effects likely to include loss of concentration, annoyance, and a reduction in speech intelligibility.

Future receivers constructed within 76m of the works could experience unmitigated noise levels that exceed the 70 dB L_{Aeq} noise criterion during high noise generating activities such as the pavement works.

Operation of construction equipment will be intermittent in nature. Construction will be linear so as the equipment moves away from the receiver noise levels will reduce. The worst-case situations, where mitigated noise levels could reach 85 dB L_{Aeq} at the closest receivers, are not expected to be frequent,

due to the setback distances to the majority of the proposed works and the use of equipment with lower source noise levels for large portions of the works. It is therefore predicted that mitigated noise levels can comply with the 70 dB L_{Aeq} noise criterion for most of the construction works.

If a critical activity has to be carried out during the night-time in close proximity to residential receivers, consultation and mitigation measures will be essential. The use of noisy equipment should be avoided where practicable to prevent sleep disturbance. Any night-time works are likely to be limited in duration and will be managed through the CNVMP and a Schedule.

11.2.2 Construction Vibration Effects

Existing receivers near Matakana Road are predominantly residential type structures. Nine existing dwellings may experience vibration levels above 5mm/s PPV exceeding the Category B criterion, if the roller compactor is used on the construction boundary in the closest position to them. Once the compactor is 8m away from the dwellings the Category B criterion will be met. No commercial receivers are predicted to exceed the Category B criterion. The Category B criteria would be met at future residential structures that are 8m or more from the proposed works and commercial structures that are 4m or more from the proposed works.

Without mitigation, at these receivers there is potential for cosmetic damage to buildings (such as cracking) and annoyance from perception of vibration. Mitigation such as the use of non-vibratory compaction equipment within 8m of buildings is recommended to avoid potential cosmetic damage.

The Category A vibration amenity criteria could be exceeded in existing or future buildings if they are occupied during the works and within 21 m of the roller compactor or within the emission radii identified for the other vibration generating equipment in Table 6-4. The effect on receivers would be subject to their respective proximity to the works but could include steady vibration from the roller compactor or a small jolt from a digger which could rattle crockery and glassware.

Vibration can typically be tolerated inside buildings if it occurs intermittently during the day, is of limited duration and where there is effective prior engagement.

High vibration generating activities should not occur during the night-time in close proximity to residential receivers to avoid sleep disturbance, unless it is a critical activity and there is no alternative.

It should also be noted that the emission radii are conservative and vibration levels measured on site tend to be much lower than those predicted in the early stages of a project.

11.3 Conclusions

The predicted construction noise and vibration levels are based on indicative information to support this NoR, as set out in Section 6, and any conclusions in this assessment should be confirmed during the detailed design stage, taking account of the receivers as they exist at the time of construction.

Construction noise and vibration can be mitigated and managed, utilising the measures set out in Section 7.2, to generally comply with the applicable limits as defined in the AUP:OP. Exceedances of the criteria could occur intermittently over a short duration if high noise or vibration generating equipment are used near occupied buildings. Where an exceedance is predicted at any receiver that

exists at the time of construction, the effects will be mitigated and managed through the CNVMP and Schedules.

A CNVMP is the most effective way to avoid, remedy or mitigate construction noise and vibration effects on receivers.

12 NOR 5 – Sandspit Road Upgrade

12.1 Overview and description of works

Sandspit Road is an existing arterial providing east-west connection between the Warkworth growth area and the towns of Sandspit and Snells Beach. This project extends from the tie in with the Hill Street intersection upgrade Project in the west and to the eastern FUZ boundary.

It is proposed to upgrade Sandspit Road to a two-lane urban arterial with cycle lanes and footpaths on both sides. The proposed upgrade will improve accessibility for active mode users to social and economic opportunities around the Warkworth growth area and contribute to improved safety outcomes along the corridor.

Refer back to the AEE in Volume 2 for a more detailed description of works to be authorised.

12.1.1 Noise Environment

Sandspit Road currently runs through urban and rural environments. In the rural area there are a few dwellings near the road. The noise environment is dominated by road traffic noise from vehicles using Sandspit Road and the surrounding road network.

The land on both sides of the corridor is zoned as FUZ. There is a high likelihood of urban development in the FUZ to the north of the corridor. This is signalled in the Warkworth Structure Plan as land use change to Residential – Single House Zone. An increase in ambient noise levels is expected as the area urbanises.

Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the overall Warkworth package.

12.2 Assessment of Construction Noise and Vibration Effects

12.2.1 Construction Noise Effects

Receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 4m away. High noise generating activities may not occur right on the construction boundary but if they do, 17 existing properties could experience unmitigated noise levels that exceed the daytime noise criterion. Details of all properties where the criteria could be exceeded are provided in Appendix A.

With mitigation in place as set out in Section 7.2, noise levels of up to 83 dB L_{Aeq} could still occur intermittently at the closest receivers, if high noise generating activities occur on the construction boundary. At this level effects likely to include loss of concentration, annoyance, and a reduction in speech intelligibility. We note that the existing receivers on FUZ zoned land may not be present at the time of construction.

Future receivers constructed within 76m of the works could experience unmitigated noise levels that exceed the 70 dB L_{Aeq} noise criterion during high noise generating activities such as the pavement works.

Operation of construction equipment will be intermittent in nature. Construction will be linear so as the equipment moves away from the receiver noise levels will reduce. The worst-case situations, where mitigated noise levels could reach 83 dB L_{Aeq} at the closest receivers, are not expected to be frequent, due to the setback distances to the majority of the proposed works and the use of equipment with lower source noise levels for large portions of the works. It is therefore predicted that mitigated noise levels can comply with the 70 dB L_{Aeq} noise criterion for most of the construction works.

If a critical activity has to be carried out during the night-time in close proximity to residential receivers, consultation and mitigation measures will be essential. The use of noisy equipment should be avoided where practicable to prevent sleep disturbance. Any night-time works are likely to be limited in duration and will be managed through the CNVMP and a Schedule.

12.2.2 Construction Vibration Effects

Existing receivers near Sandspit Road are predominantly residential type structures. One existing dwellings may experience vibration levels above 5mm/s PPV, exceeding the Category B criterion for residential structures, if the roller compactor is used on the construction boundary in the closest position to them. No commercial receivers are predicted to exceed the Category B criterion. Once the compactor is 8m away from the dwellings the Category B criterion will be met. The Category B criteria would be met at future residential structures that are 8m or more from the proposed works and commercial structures that are 4m or more from the proposed works.

Without mitigation, at these receivers there is potential for cosmetic damage to buildings (such as cracking) and annoyance from perception of vibration. Mitigation such as the use of non-vibratory compaction equipment within 8m of buildings is recommended to avoid potential cosmetic damage.

The daytime Category A vibration amenity criteria could be exceeded in existing or future buildings if they are occupied during the works and within 21 m of the roller compactor or within the emission radii identified for the other vibration generating equipment in Table 6-4. The effect on receivers would be subject to their respective proximity to the works but could include steady vibration from the roller compactor or a small jolt from a digger which could rattle crockery and glassware.

Vibration can typically be tolerated inside buildings if it occurs intermittently during the day, is of limited duration and where there is effective prior engagement.

High vibration generating activities should not occur during the night-time in close proximity to residential receivers to avoid sleep disturbance, unless it is a critical activity and there is no alternative.

It should also be noted that the emission radii are conservative and vibration levels measured on site tend to be much lower than those predicted in the early stages of a project.

12.3 Conclusions

The predicted construction noise and vibration levels are based on indicative information to support this NoR, as set out in Section 6, and any conclusions in this assessment should be confirmed during the detailed design stage, taking account of the receivers as they exist at the time of construction.

Construction noise and vibration can be mitigated and managed, utilising the measures set out in Section 7.2, to generally comply with the applicable limits as defined in the AUP:OP. Exceedances of

the criteria could occur intermittently over a short duration if high noise or vibration generating equipment are used near occupied buildings. Where an exceedance is predicted at any receiver that exists at the time of construction, the effects will be mitigated and managed through the CNVMP and Schedules.

A CNVMP is the most effective way to avoid, remedy or mitigate construction noise and vibration effects on receivers.

13 NOR 6 – Western Link - South

13.1 Overview and description of works

The New Western Link - South is located at the end of Evelyn Street in the north to SH1 in the south and runs through existing greenfield land. The New Western Link - South Project involves the construction of a new two-lane urban arterial with walking and cycling facilities on both sides and upgrading the intersection with McKinney Road

The new corridor will provide key north-south connection in the Warkworth network. The purpose of the Western Link is to enable development in west Warkworth and provide access to FUZ land and industrial areas while taking pressure off the existing SH1 and Hill Street intersection.

Refer back to the AEE in Volume 2 for a more detailed description of works to be authorised.

13.1.1 Noise Environment

The majority of land adjacent to the new Western Link - South is currently zoned as FUZ. There is a small area zoned as Business – Light Industry Zone, some of which is currently undeveloped.

The Warkworth Structure Plan indicates that the area to the South and West of the Wider Western Link is likely to be zoned as Residential. This zoning plus full development of the Business – Light Industry Zone would likely result in an increase in ambient noise levels as the area urbanises.

The noise environment is dominated by road traffic noise from vehicles on the nearby road network.

Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the overall Warkworth package.

13.2 Assessment of Construction Noise and Vibration Effects

13.2.1 Construction Noise Effects

Receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 17m from the designation. High noise generating activities may not occur right on the construction boundary but if they do, 29 existing receivers could experience unmitigated noise levels that exceed the daytime noise criterion. Details of all properties where criteria could be exceeded are provided in Appendix A.

With mitigation in place as set out in Section 7.2, noise levels of up to 72 dB L_{Aeq} could still occur intermittently at the closest receivers, if high noise generating activities occur on the construction boundary. At this level effects likely to include loss of concentration, annoyance, and a reduction in speech intelligibility. We note that the existing receivers on FUZ zoned land may not be present at the time of construction.

Future receivers constructed within 76m of the works could experience unmitigated noise levels that exceed the 70 dB L_{Aeq} noise criterion during high noise generating activities such as the pavement works.

Operation of construction equipment will be intermittent in nature. Construction will be linear so as the equipment moves away from the receiver noise levels will reduce. The worst-case situations, where mitigated noise levels could reach 72 dB L_{Aeq} at the closest receivers, are not expected to be frequent, due to the setback distances to the majority of the proposed works and the use of equipment with lower source noise levels for large portions of the works. It is therefore predicted that mitigated noise levels can comply with the 70 dB L_{Aeq} noise criterion for most of the construction works.

If a critical activity has to be carried out during the night-time in close proximity to residential receivers, consultation and mitigation measures will be essential. The use of noisy equipment should be avoided where practicable to prevent sleep disturbance. Any night-time works are likely to be limited in duration and will be managed through the CNVMP and a Schedule.

13.2.2 Construction Vibration Effects

Existing receivers near the Western Link - South are a mix of residential and commercial type structures. No existing buildings are predicted to experience vibration levels above the Category B vibration criteria (5mm/s PPV for residential structures), even if the roller compactor is used on the construction boundary in the closest position to them.

The Category B criteria would be met at future residential structures that are 8m or more from the proposed works and commercial structures that are 4m or more from the proposed works.

The Category A vibration amenity criteria could be exceeded in existing or future buildings if they are occupied during the works and within 21 m of the roller compactor or within the emission radii identified for the other vibration generating equipment in Table 6-4. The effect on receivers would be subject to their respective proximity to the works but could include steady vibration from the roller compactor or a small jolt from a digger which could rattle crockery and glassware.

Vibration can typically be tolerated inside buildings if it occurs intermittently during the day, is of limited duration and where there is effective prior engagement.

High vibration generating activities should not occur during the night-time in close proximity to residential receivers to avoid sleep disturbance, unless it is a critical activity and there is no alternative.

It should also be noted that the emission radii are conservative and vibration levels measured on site tend to be much lower than those predicted in the early stages of a project.

13.3 Conclusions

The predicted construction noise and vibration levels are based on indicative information to support this NoR, as set out in Section 6, and any conclusions in this assessment should be confirmed during the detailed design stage, taking account of the receivers as they exist at the time of construction.

Construction noise and vibration can be mitigated and managed, utilising the measures set out in Section 7.2, to generally comply with the applicable limits as defined in the AUP:OP. Exceedances of the criteria could occur intermittently over a short duration if high noise or vibration generating equipment are used near occupied buildings. Where an exceedance is predicted at any receiver that exists at the time of construction, the effects will be mitigated and managed through the CNVMP and Schedules.

A CNVMP is the most effective way to avoid, remedy or mitigate construction noise and vibration effects on receivers.

14 NOR 7 – Sandspit Link

14.1 Overview and description of works

Sandspit Link is a proposed new road with the purpose of providing strategic east-west movements to Matakana and Kowhai Coasts and providing local access to the northern growth area. The corridor extends from Matakana Road in the north-west and connects to Sandspit Road in the southeast. The alignment provides a resilient alternative to SH1 and Hill Street Intersection whilst improving dual accessibility between the northern growth area and Warkworth.

The Sandspit Link Project involves the construction of a two-lane urban arterial with cycle lanes and footpaths on both sides and a new intersection at the connection with Sandspit Road.

Refer back to the AEE in Volume 2 for a more detailed description of works to be authorised.

14.1.1 Noise Environment

The proposed Sandspit Link runs through a currently rural environment. In the rural area there are few dwellings near existing roads. The noise environment is dominated by road traffic noise from vehicles using the Matakana Road and the surrounding road network as well as noise associated with the nearby quarry.

Sandspit Link is zoned as FUZ on both sides of the alignment. To the northeast of the alignment is an existing Special Purpose – Quarry Zone.

The Warkworth Structural Plan indicates that the land surrounding the proposed Sandspit Link is likely to be zoned Residential. This zoning would likely result in an increase in ambient noise levels as the area urbanises.

Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the overall Warkworth package.

14.2 Assessment of Construction Noise and Vibration Effects

14.2.1 Construction Noise Effects

Receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 15m. High noise generating activities may not occur right on the construction boundary but if they do, 5 existing properties could experience unmitigated noise levels that exceed the daytime noise criterion. Details of all properties where the criteria could be exceeded are provided in Appendix A

With mitigation in place as set out in Section 7.2, noise levels of up to 74 dB L_{Aeq} could still occur intermittently at the closest receivers, if high noise generating activities occur on the construction boundary. At this level effects likely to include loss of concentration, annoyance, and a reduction in speech intelligibility. We note that the existing receivers on FUZ zoned land may not be present at the time of construction.

Future receivers constructed within 76m of the works could experience unmitigated noise levels that exceed the 70 dB L_{Aeq} noise criterion during high noise generating activities such as the pavement works.

Operation of construction equipment will be intermittent in nature. Construction will be linear so as the equipment moves away from the receiver noise levels will reduce. The worst-case situations, where mitigated noise levels could reach 74 dB L_{Aeq} at the closest receivers, are not expected to be frequent, due to the setback distances to the majority of the proposed works and the use of equipment with lower source noise levels for large portions of the works. It is therefore predicted that mitigated noise levels can comply with the 70 dB L_{Aeq} noise criterion for most of the construction works.

If a critical activity has to be carried out during the night-time in close proximity to residential receivers, consultation and mitigation measures will be essential. The use of noisy equipment should be avoided where practicable to prevent sleep disturbance. Any night-time works are likely to be limited in duration and will be managed through the CNVMP and a Schedule.

14.2.2 Construction Vibration Effects

Existing receivers near the proposed Sandspit Link are a mix of residential and commercial type structures. No existing buildings are predicted to experience vibration levels above the Category B vibration criteria (5mm/s PPV for residential structures), even if the roller compactor is used on the construction boundary in the closest position to them.

The Category B criteria would be met at future residential structures that are 8m or more from the proposed works and commercial structures that are 4m or more from the proposed works.

The Category A vibration amenity criteria could be exceeded in existing or future buildings if they are occupied during the works and within 21 m of the roller compactor or within the emission radii identified for the other vibration generating equipment in Table 6-4. The effect on receivers would be subject to their respective proximity to the works but could include steady vibration from the roller compactor or a small jolt from a digger which could rattle crockery and glassware.

Vibration can typically be tolerated inside buildings if it occurs intermittently during the day, is of limited duration and where there is effective prior engagement.

High vibration generating activities should not occur during the night-time in close proximity to residential receivers to avoid sleep disturbance, unless it is a critical activity and there is no alternative.

It should also be noted that the emission radii are conservative and vibration levels measured on site tend to be much lower than those predicted in the early stages of a project.

14.3 Conclusions

The predicted construction noise and vibration levels are based on indicative information to support this NOR, as set out in Section 6, and any conclusions in this assessment should be confirmed during the detailed design stage, taking account of the receivers as they exist at the time of construction.

Construction noise and vibration can be mitigated and managed, utilising the measures set out in Section 7.2, to generally comply with the applicable limits as defined in the AUP:OP. Exceedances of the criteria could occur intermittently over a short duration if high noise or vibration generating

equipment are used near occupied buildings. Where an exceedance is predicted at any receiver that exists at the time of construction, the effects will be mitigated and managed through the CNVMP and Schedules.

A CNVMP is the most effective way to avoid, remedy or mitigate construction noise and vibration effects on receivers.

15 NOR 8 – Wider Western Link – North

15.1 Overview and description of works

The Wider Western Link is a proposed new arterial extending from Woodcocks Road in the north to SH1 in the south. The extent of the proposed new Wider Western Link (northern section) is from Woodcocks Road in the north to the midway point of the Warkworth South FUZ and is inclusive of the Mahurangi River.

The Wider Western Link (northern section) project involves the construction of a two-lane urban arterial with walking and cycling facilities on both sides. The corridor connects the Southern Interchange to Woodcocks Road and SH1 and, provides access into the southern FUZ where access will otherwise be difficult due to topography and streams.

Refer back to the AEE in Volume 2 for a more detailed description of works to be authorised.

15.1.1 Noise Environment

The Wider Western Link runs through a predominantly rural area with some residential dwellings located close to the road corridor. The noise environment is dominated by road traffic noise from vehicles on Woodcocks Road.

The Warkworth Structural Plan indicates that the area surrounding the Wider Western Link is likely to be zoned as Heavy Industry Zone and Residential Zones. This zoning would likely result in an increase in ambient noise levels as the area urbanises compared to the current rural nature.

15.2 Assessment of Construction Noise and Vibration Effects

15.2.1 Construction Noise Effects

Receivers are located at varying distances from the construction boundary along the alignment with the closest existing receiver being 10m. High noise generating activities may not occur right on the construction boundary, but if they do, 4 existing properties could experience unmitigated noise levels that exceed the daytime noise criterion. Details of all properties where the criteria could be exceeded are provided in Appendix A.

With mitigation in place as set out in Section 7.2, noise levels of up to 76 dB L_{Aeq} could still occur intermittently at the closest receivers, if high noise generating activities occur on the construction boundary. At this level effects likely to include loss of concentration, annoyance, and a reduction in speech intelligibility. We note that the existing receivers on FUZ zoned land may not be present at the time of construction.

Future receivers constructed within 76m of the works could experience unmitigated noise levels that exceed the 70 dB L_{Aeq} noise criterion during high noise generating activities such as the pavement works.

Operation of construction equipment will be intermittent in nature. Construction will be linear so as the equipment moves away from the receiver noise levels will reduce. The worst-case situations, where

mitigated noise levels could reach 76 dB L_{Aeq} at the closest receivers, are not expected to be frequent, due to the setback distances to the majority of the proposed works and the use of equipment with lower source noise levels for large portions of the works. It is therefore predicted that mitigated noise levels can comply with the 70 dB L_{Aeq} noise criterion for most of the construction works.

If a critical activity has to be carried out during the night-time in close proximity to residential receivers, consultation and mitigation measures will be essential. The use of noisy equipment should be avoided where practicable to prevent sleep disturbance. Any night-time works are likely to be limited in duration and will be managed through the CNVMP and a Schedule.

15.2.2 Construction Vibration Effects

Existing receivers near Wider Western Link are predominantly residential type structures. No existing buildings are predicted to experience vibration levels above the Category B vibration criteria (5mm/s PPV for residential structures), even if the roller compactor is used on the construction boundary in the closest position to them.

The Category B criteria would be met at future residential structures that are 8m or more from the proposed works and commercial structures that are 4m or more from the proposed works.

The daytime Category A vibration amenity criteria could be exceeded in existing or future buildings if they are occupied during the works and within 21 m of the roller compactor or within the emission radii identified for the other vibration generating equipment in Table 6-4. The effect on receivers would be subject to their respective proximity to the works but could include steady vibration from the roller compactor or a small jolt from a digger which could rattle crockery and glassware.

Vibration can typically be tolerated inside buildings if it occurs intermittently during the day, is of limited duration and where there is effective prior engagement.

High vibration generating activities should not occur during the night-time in close proximity to residential receivers to avoid sleep disturbance, unless it is a critical activity and there is no alternative.

It should also be noted that the emission radii are conservative and vibration levels measured on site tend to be much lower than those predicted in the early stages of a project.

15.3 Conclusions

The predicted construction noise and vibration levels are based on indicative information to support this NoR, as set out in Section 6, and any conclusions in this assessment should be confirmed during the detailed design stage, taking account of the receivers as they exist at the time of construction.

Construction noise and vibration can be mitigated and managed, utilising the measures set out in Section 7.2, to generally comply with the applicable limits as defined in the AUP:OP. Exceedances of the criteria could occur intermittently over a short duration if high noise or vibration generating equipment are used near occupied buildings. Where an exceedance is predicted at any receiver that exists at the time of construction, the effects will be mitigated and managed through the CNVMP and Schedules.

A CNVMP is the most effective way to avoid, remedy or mitigate construction noise and vibration effects on receivers.

16 Conclusions

An assessment of the construction noise and vibration effects due to the Warkworth Package has been undertaken for the Projects considering a worst case scenario. The predicted noise and vibration levels and effects are based on indicative information as provided by the Project team and any assessment conclusions should be confirmed during the detailed design stage, taking account of the final equipment selections, methodology and receivers as they exist at the time of construction.

Construction noise and vibration can be mitigated and managed, utilising the measures set out in Section 7.2, to comply with the applicable limits for the majority of the works. Exceedances of the criteria could occur intermittently across all NoRs, if high noise or vibration generating equipment is used near occupied buildings. The most impacted receivers are located within 10m of the construction boundary.

Night works will be limited to critical activities that cannot be carried out at any other time.

A CNVMP will be prepared prior to construction commencing in accordance with Section 7.2.1 of this report. The CNVMP will provide a framework for the development and implementation of best practicable options to avoid, remedy or mitigate the adverse effects of construction noise and vibration on receivers that exist at the time of construction. Communication and consultation will occur with the affected receivers and Schedules will be prepared if required.

Elevated noise levels should be avoided and mitigated where possible to reduce the likelihood of adverse effects such as loss of concentration, annoyance and sleep disturbance (for night works).

Whilst vibration levels at the daytime Category A criterion of 2mm/s PPV can generally be tolerated if activity occurs intermittently and with prior notice, communication and consultation will be the key management measure to avoid annoyance and concern. Where vibration levels are predicted to exceed the Category B criteria, and where the construction methodology cannot be changed to reduce vibration levels, building condition surveys are recommended.

Overall, construction noise and vibration can be controlled for all NORs to reasonable levels with the implementation of appropriate mitigation and management measures.

1 Appendix A: Receivers Exceeding Construction Noise Criteria

NoR 1

Address	Building Type/Structure
42 State Highway 1	Residential

NoR 2

Address	Building Type/Structure
314 Woodcocks Road	Residential
127A Woodcocks Road	Residential
346 Woodcocks Road	Residential
286 Woodcocks Road	Residential
1 Mason Heights	Residential
371 Woodcocks Road	Residential
2 Mason Heights	Residential
314A Woodcocks Road	Residential
372 Woodcocks Road	Residential
12 Oliver Street	Residential
8 Oliver Street	Residential
10 Oliver Street	Residential
3 Mason Heights	Residential
20 Oliver Street	Residential
4 Oliver Street	Residential
6 Oliver Street	Residential
18 Oliver Street	Residential
16 Oliver Street	Residential
14 Oliver Street	Residential
6 Evelyn Street	Residential
87 Woodcocks Road	Residential
326 Falls Road	Residential
5 Evelyn Street	Residential
317 Woodcocks Road	Residential
153 Woodcocks Road	Residential

NoR 3

Address	Building Type/Structure
1/18 Wech Drive	Residential
8E McKinney Road	Residential
1659 State Highway 1	Residential
8 Toovey Road	Commercial
9 McKinney Road	Residential
8F McKinney Road	Residential
27B Campbell Drive	Residential
1723 State Highway 1	Residential
43 Auckland Road	Commercial
6 McKinney Road	Residential
24 Wickens Place	Residential
33 Campbell Drive	Residential
22 Wickens Place	Residential
1/6 Wech Drive	Residential
17 Wech Drive	Residential
13 Wickens Place	Residential
25 Campbell Drive	Residential
15 Wech Drive	Residential
14 Wech Drive	Residential
67 Auckland Road	Commercial
1794 State Highway 1	Commercial
11 Wickens Place	Resiential
11 Wech Drive	Resiential
12 Wech Drive	Resiential
37 Campbell Drive	Resiential
7 McKinney Road	Resiential
35 Campbell Drive	Resiential
1848 State Highway 1	Resiential
16 Wech Drive	Resiential
7 Wech Drive	Resiential
23 Campbell Drive	Resiential
19 Wech Drive	Resiential
22 Wech Drive	Resiential
21 Campbell Drive	Resiential
1673 State Highway 1	Resiential
1/1 Fairwater Road	Commercial
8A Wech Drive	Residential
21 Wickens Place	Residential
1 Wech Drive	Commercial
21 Wech Drive	Resiential
1728 State Highway 1	Resiential
23 Wickens Place	Resiential
2/18 Wech Drive	Resiential
20 Wickens Place	Resiential
9 Wickens Place	Resiential
4 Wech Drive	Resiential
3/4 Fairwater Road	Commercial
5 Wech Drive	Residential
27 Campbell Drive	Residential
1/4 Fairwater Road	Residential
19 Campbell Drive	Residential
25 Wickens Place	Residential
3 Wech Drive	Residential
1773 State Highway 1	Residential
19 Wickens Place	Residential
31 Campbell Drive	Residential
2/6 Wech Drive	Residential
18 Wickens Place	Residential
17 Wickens Place	Residential
9 Wech Drive	Residential
39 Campbell Drive	Residential
8D McKinney Road	Residential
12A Wech Drive	Residential
20 Wech Drive	Residential
17A Wech Drive	Residential
4A Wech Drive	Residential
17 Campbell Drive	Residential
8B McKinney Road	Residential
29 Campbell Drive	Residential
7 Wickens Place	Residential
16 Wickens Place	Residential
1829 State Highway 1	Residential
3/6 Wech Drive	Residential
3/6 Fairwater Road	Commercial
5 Wickens Place	Residential
3 Wickens Place	Residential
1695A Valerie Cl	Residential
1684 State Highway 1	Residential
41 Campbell Drive	Residential
15 Campbell Drive	Residential
1695B Valerie Cl	Residential
14 Wickens Place	Residential
7A Wech Drive	Residential
3B Wech Drive	Residential
8 Wech Drive	Residential
7 Toovey Road	Residential
43 Campbell Drive	Residential
3/9 Fairwater Road	Commercial
8C McKinney Road	Residential
12 Wickens Place	Residential
20 Campbell Drive	Residential

NoR 4

Address	Building Type/Structure
130 Matakana Road	Residential
1 Melwood Drive	Residential
19 Northwood Close	Residential
98 Matakana Road	Residential
160 Matakana Road	Residential
190 Matakana Road	Residential
303 Matakana Road	Residential
170 Matakana Road	Residential
299 Matakana Road	Residential
304 Matakana Road	Residential
297 Matakana Road	Residential
165 Matakana Road	Residential
223 Matakana Road	Residential
2 Melwood Drive	Residential
4 Clayden Road	Residential
2 Clayden Road	Residential
76 Matakana Road	Residential
301 Matakana Road	Residential
120 Matakana Road	Residential
59 Northwood Close	Residential
3 Matakana Road	Residential
211 Matakana Road	Residential
4 Melwood Drive	Residential
23 Northwood Close	Residential
5 Matakana Road	Residential
3 Melwood Drive	Residential
57 Northwood Close	Residential
293 Matakana Road	Residential
140 Matakana Road	Residential
185 Matakana Road	Residential
245 Matakana Road	Residential
41 Northwood Close	Residential
17 Northwood Close	Residential
39 Northwood Close	Residential
295 Matakana Road	Residential
33 Northwood Close	Residential
6 Clayden Road	Residential
49 Matakana Road	Residential
31 Northwood Close	Residential
171 Matakana Road	Residential
45 Northwood Close	Residential
43 Northwood Close	Residential
25 Northwood Close	Residential
15 Northwood Close	Residential
37 Northwood Close	Residential
47 Northwood Close	Residential
2 Millstream Place	Residential
35 Northwood Close	Residential
55 Northwood Close	Residential
61 Northwood Close	Residential
6 Millstream Place	Residential
29 Northwood Close	Residential
40 Clayden Road	Residential

NoR 5

Address	Building Type/Structure
4 Millstream Place	Residential
209 Sandspit Road	Residential
6 Millstream Place	Residential
108 Sandspit Road	Residential
384 Sandspit Road	Residential
10 Millstream Place	Residential
1 Millstream Place	Residential
3 Millstream Place	Residential
8 Millstream Place	Residential
137 Sandspit Road	Residential
5 Millstream Place	Residential
12 Millstream Place	Residential
7 Millstream Place	Residential
14 Millstream Place	Residential
9 Millstream Place	Residential
146 Sandspit Road	Residential
109 Sandspit Road	Residential

NoR 6

Address	Building Type/Structure
2 Jamie Lane	Residential
4 Jamie Lane	Residential
6 Jamie Lane	Residential
1 Christopher Lane	Residential
10 Georgetti Way	Residential
3 Christopher Lane	Residential
73 Woodcocks Road	Commercial
3 Dunningham Street	Residential
9 Dunningham Street	Residential
5 Dunningham Street	Residential
8 Jamie Lane	Residential
7 Dunningham Street	Residential
5 Christopher Lane	Residential
1 McKinney Road	Residential
10 Jamie Lane	Residential
8 Georgetti Way	Residential
7 Christopher Lane	Residential
22 Wech Drive	Residential
3 McKinney Road	Residential
77 Morrison Drive	Commercial
12 Jamie Lane	Residential
9 Christopher Lane	Residential
6 Georgetti Way	Residential
2 Christopher Lane	Residential
4 Christopher Lane	Residential
1848 State Highway 1	Residential
21 Wech Drive	Residential
13 Christopher Lane	Residential
6 Christopher Lane	Residential

NoR 7

Address	Building Type/Structure
195 Sandspit Road	Residential
137 Sandspit Road	Residential
169 Sandspit Road	Residential
179 Sandspit Road	Residential
209 Sandspit Road	Residential

NoR 8

Address	Building Type/Structure
346 Woodcocks Road	Residential
12 Wyllie Road	Residential
314A Woodcocks Road	Residential
123 Valerie Close	Residential

2 Appendix B: Receivers Exceeding Construction Vibration Criteria

NoR 2

Address	Building Type/Structure
314 Woodcocks Road	Residential

NoR 3

Address	Building Type/Structure
1/18 Wech Drive	Residential
8E McKinney Road	Residential
1659 State Highway 1	Residential
9 McKinney Road	Residential
8F McKinney Road	Residential
27B Campbell Drive	Residential
1723 State Highway 1	Residential
6 McKinney Road	Residential
24 Wickens Place	Residential
33 Campbell Drive	Residential
22 Wickens Place	Residential
1/6 Wech Drive	Residential

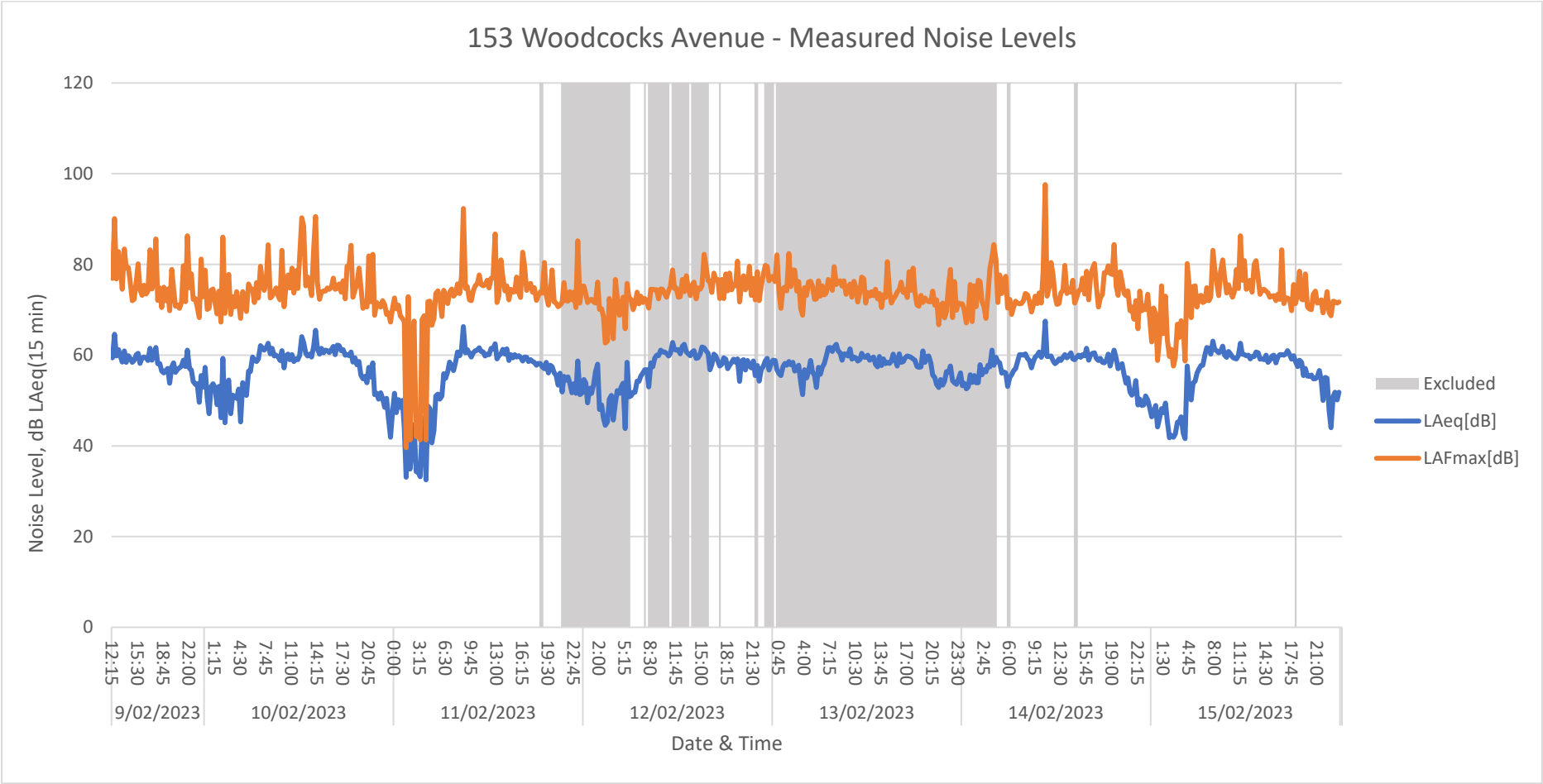
NoR 4

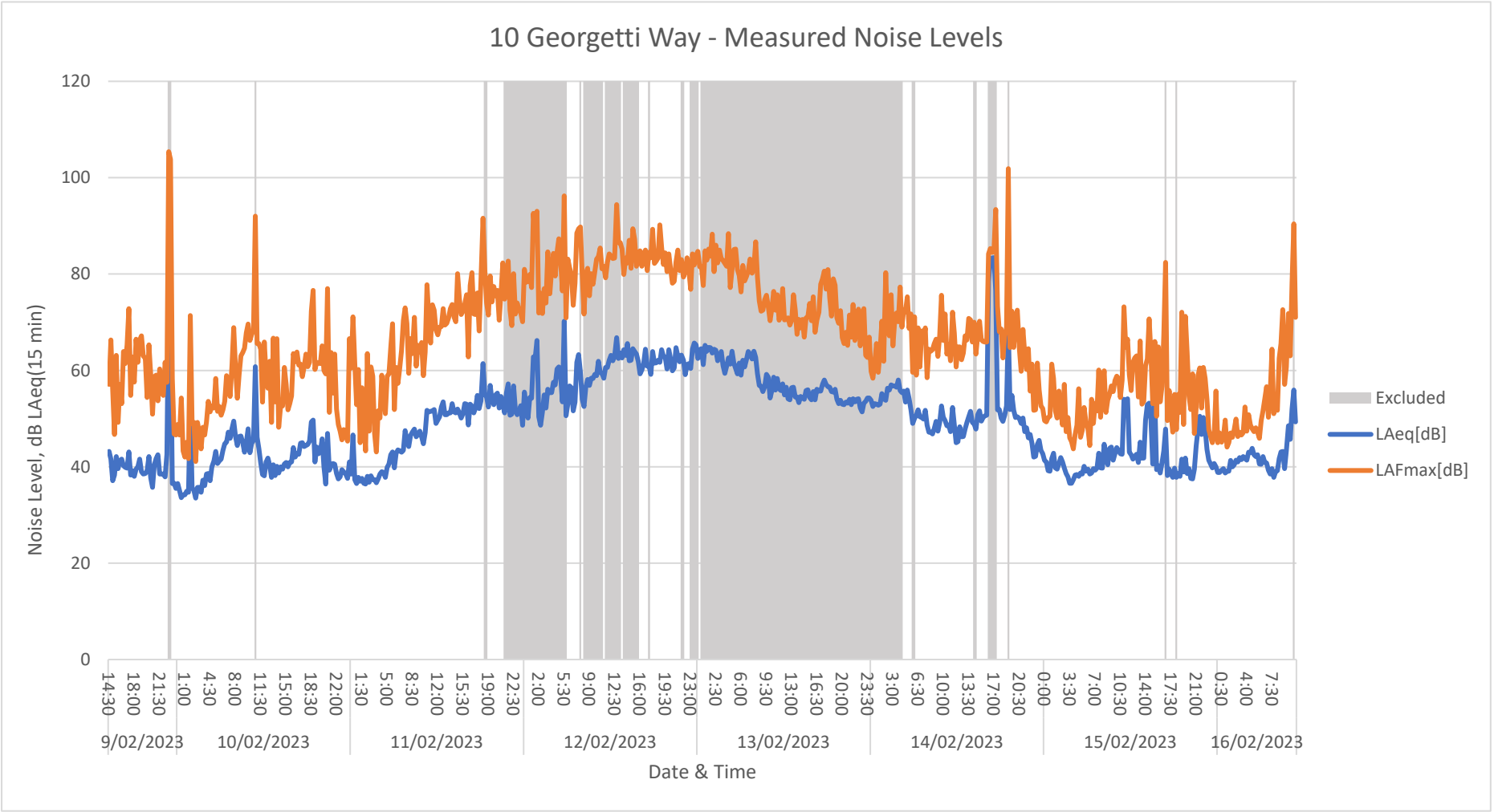
Address	Building Type/Structure
130 Matakana Road	Residential
1 Melwood Drive	Residential
19 Northwood Close	Residential
98 Matakana Road	Residential
160 Matakana Road	Residential
190 Matakana Road	Residential
303 Matakana Road	Residential
170 Matakana Road	Residential
299 Matakana Road	Residential

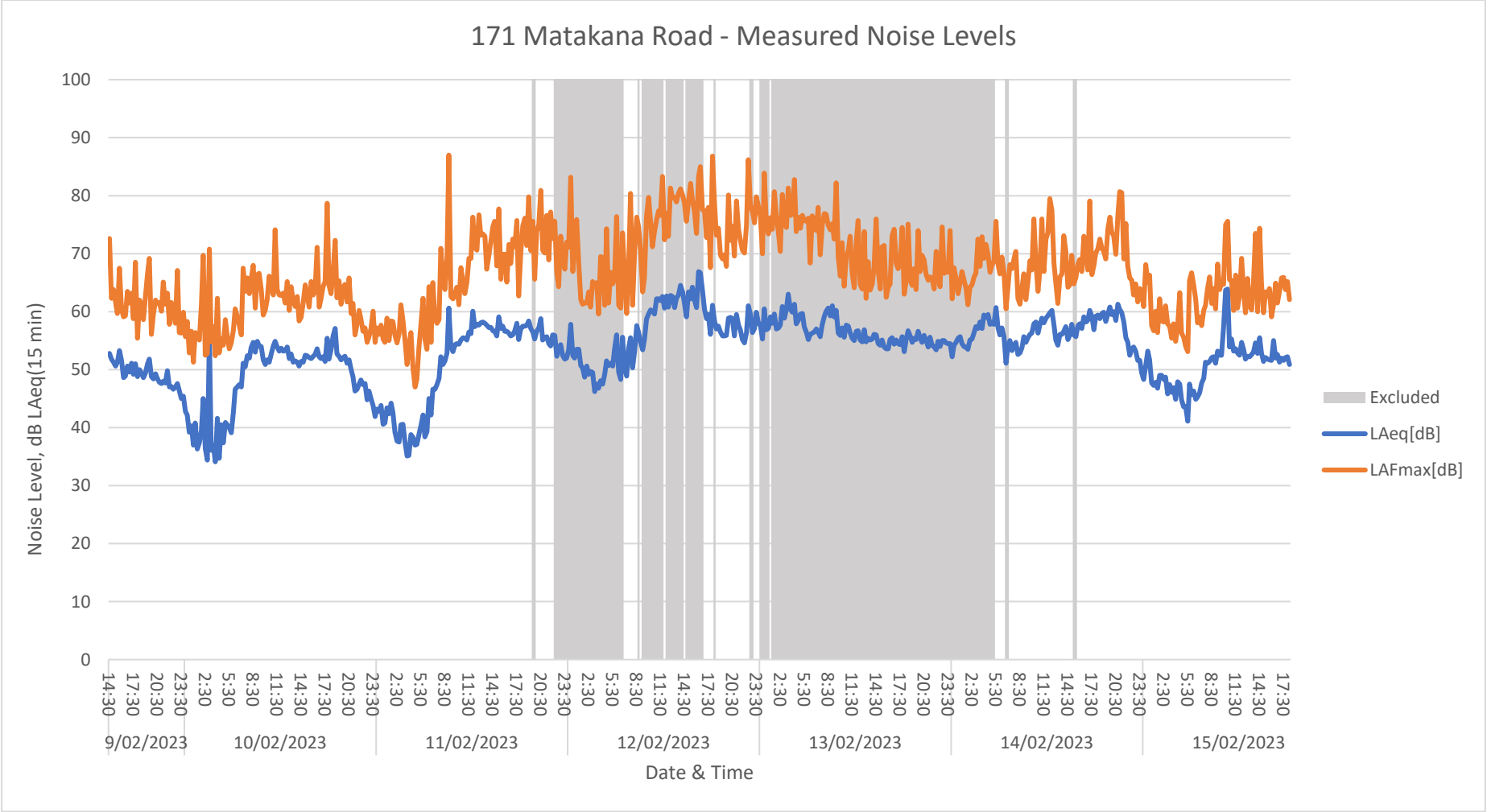
NoR 5

Address	Building Type/Structure
4 Millstream Place	Residential

3 Appendix C: Unattended Noise Monitoring Results


153 Woodcocks Avenue - Measured Noise Levels
Noise Level, dB LAeq(15 min)
120
100
80
60
40
20
0
12:15
15:30
18:45
22:00
1:15
4:30
7:45
11:00
14:15
17:30
20:45
0:00
3:15
6:30
9:45
13:00
16:15
19:30
22:45
2:00
5:15
8:30
11:45
15:00
18:15
21:30
0:45
4:00
7:15
10:30
13:45
17:00
20:15
23:30
2:45
6:00
9:15
12:30
15:45
19:00
22:15
1:30
4:45
8:00
11:15
14:30
17:45
21:00
9/02/2023
10/02/2023
11/02/2023
12/02/2023
13/02/2023
14/02/2023
15/02/2023
Date & Time
Excluded
LAeq[dB]
LAFmax[dB]


10 Georgetti Way - Measured Noise Levels
Noise Level, dB LAeq(15 min)
120
100
80
60
40
20
0
14:30
18:00
21:30
1:00
4:30
8:00
11:30
15:00
18:30
22:00
1:30
5:00
8:30
12:00
15:30
19:00
22:30
2:00
5:30
9:00
12:30
16:00
19:30
23:00
2:30
6:00
9:30
13:00
16:30
20:00
23:30
3:00
6:30
10:00
13:30
17:00
20:30
0:00
3:30
7:00
10:30
14:00
17:30
21:00
0:30
4:00
7:30
9/02/2023
10/02/2023
11/02/2023
12/02/2023
13/02/2023
14/02/2023
15/02/2023
16/02/2023
Date & Time
Excluded
LAeq[dB]
LAFmax[dB]


171 Matakana Road - Measured Noise Levels
Noise Level, dB LAeq(15 min)
100
90
80
70
60
50
40
30
20
10
0
14:30
17:30
20:30
23:30
2:30
5:30
8:30
11:30
14:30
17:30
20:30
23:30
2:30
5:30
8:30
11:30
14:30
17:30
20:30
23:30
2:30
5:30
8:30
11:30
14:30
17:30
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23:30
2:30
5:30
8:30
11:30
14:30
17:30
20:30
23:30
2:30
5:30
8:30
11:30
14:30
17:30
9/02/2023
10/02/2023
11/02/2023
12/02/2023
13/02/2023
14/02/2023
15/02/2023
Date & Time
Excluded
LAeq[dB]
LAFmax[dB]

4 Appendix D: Noise Monitoring Forms

NOISE MONITORING FORM – 10 Georgetti Way				
Summary				
Project name	Supporting Growth Alliance			
Project number	60558831			
Date / time	09/02/2023, 14:30pm			
Engineer(s)	Dhulkifl Ahmed			
Location (NZTM2000)	X	1747792	Y	5969208
Equipment				
Manufacturer	Rion			
Type	NL-52			
Serial number	00898330			
Date of last calibration	29/11/2021			
Calibration drift pre/post	N/A			
Noise Environment				
Which assessment method is applicable? *I.e. NZS 6802:2008 Simple / Detailed or other.*	Simple			
General description of measured noise: specific and residual levels including comments on k_1 adjustment and contamination	Dominant noise source: Road noise from Georgetti Way			
Any special audible characteristics (tonality, impulsivity etc.) and comment on k_2 adjustment	N/A			
Meteorological Conditions				
Wind speed and direction at microphone	3.6			
Wind speed and direction at dominant source(s)	3.6			
Precipitation	0			
Fog	N/A			
Temperature	18.6			
Humidity	43%			
Percentage cloud cover	60%			
Site Conditions				
Microphone height	1.5m			
Distance to dominant noise source(s)	8m			
Height of noise source(s)	Ground level			
Distance from any reflective surfaces	1.5m			
Intervening topography	N/A			
Hard, mixed or soft ground	Mixed			
Barriers between source(s) and microphone	N/A			
General comments and sketches				

Photo A: View toward the source

Photo B:

NOISE MONITORING FORM – 171 Matakana Road				
Summary				
Project name	Supporting Growth Alliance			
Project number	60558831			
Date / time	09/02/2023, 13:30pm			
Engineer(s)	Dhulkifl Ahmed			
Location (NZTM2000)	X	1748825	Y	5971672
Equipment				
Manufacturer	01dB			
Type	Cube			
Serial number	00898331			
Date of last calibration	29/11/2021			
Calibration drift pre/post	N/A			
Noise Environment				
Which assessment method is applicable? *I.e. NZS 6802:2008 Simple / Detailed or other.*	Simple			
General description of measured noise: specific and residual levels including comments on k_1 adjustment and contamination	Dominant noise source: Road noise from Matakana Rd, foliage, and insect noise from surrounding area			
Any special audible characteristics (tonality, impulsivity etc.) and comment on k_2 adjustment	N/A			
Meteorological Conditions				
Wind speed and direction at microphone	3.1 m/s			
Wind speed and direction at dominant source(s)	3.1 m/s			
Precipitation	0			
Fog	N/A			
Temperature	19.5			
Humidity	38			
Percentage cloud cover	60%			
Site Conditions				
Microphone height	1.5m			
Distance to dominant noise source(s)	30m			
Height of noise source(s)	Ground level			
Distance from any reflective surfaces	1.5m			
Intervening topography	Slight hill between noise source and receiver			
Hard, mixed or soft ground	Mixed			
Barriers between source(s) and microphone	N/A			
General comments and sketches				

Photo A: View toward the source

NOISE MONITORING FORM – 153 Woodcocks Road				
Summary				
Project name	Supporting Growth Alliance			
Project number	60558831			
Date / time	09/02/2023, 12:15pm			
Engineer(s)	Dhulkifl Ahmed			
Location (NZTM2000)	X	1747278	Y	5969508
Equipment				
Manufacturer	Rion			
Type	NL-52			
Serial number	00898331			
Date of last calibration	29/11/2021			
Calibration drift pre/post	N/A			
Noise Environment				
Which assessment method is applicable? *I.e. NZS 6802:2008 Simple / Detailed or other.*	Simple			
General description of measured noise: specific and residual levels including comments on k_1 adjustment and contamination	Dominant noise source: Road noise from Woodcocks Ave			
Any special audible characteristics (tonality, impulsivity etc.) and comment on k_2 adjustment	N/A			
Meteorological Conditions				
Wind speed and direction at microphone	3.2 m/s			
Wind speed and direction at dominant source(s)	3.2 m/s			
Precipitation	0			
Fog	N/A			
Temperature	19.2			
Humidity	42%			
Percentage cloud cover	60%			
Site Conditions				
Microphone height	1.5m			
Distance to dominant noise source(s)	10m			
Height of noise source(s)	Ground level			
Distance from any reflective surfaces	1.5m			
Intervening topography	Foliage between source and receiver			
Hard, mixed or soft ground	Mixed			
Barriers between source(s) and microphone	N/A			
General comments and sketches				

Photo A: View toward the source

ATTACHMENT 64

ASSESSMENT OF ECOLOGICAL EFFECTS
PART 1 OF 5

TE TUPU NGĀTAHI
SUPPORTING GROWTH

Warkworth Assessment of Ecological Effects

May 2023

Version 1.0

Document Status

Responsibility	Name
Author	Michel Jonker & Dannie Cullen
Reviewer	Fiona Davies, Michiel Jonker
Approver	Simon Titter

Revision Status

Version	Date	Reason for Issue
1.0	12/05/2023	Issue for lodgement

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Abbreviations

Acronym/Term	Description
AEE	Assessment of Effects on the Environment
AT	Auckland Transport
AUP:OP	Auckland Unitary Plan Operative in Part
ED	Ecological District
FUZ	Future Urban Zone
NOR	Notice of Requirement (under the Resource Management Act 1991)
Project Area	Area that is located within the designation footprint (including all its associated NORs)
RMA	Resource Management Act 1991
SG	Te Tupu Ngātahi Supporting Growth
TAR	Threatened or At Risk
The Council	Auckland Council
Waka Kotahi	Waka Kotahi NZ Transport Agency

Acronym/Term	Description
ZOI	Zone of Influence

Glossary of Acronyms / Terms

Acronym/Term	Description
Auckland Council	Means the unitary authority that replaced eight councils in the Auckland Region as of 1 November 2010.
Ecological Baseline	Means the prevailing ecological state at the time of the assessment.
Likely Future Ecological Environment	The likely future environment informed by the Auckland Unitary Plan (AUP).
Ecological Feature	Specific aspects of an ecosystem that are described and evaluated; the term includes components such as species and habitats and related processes and functions, such as habitat buffers and roosting and feeding habitat.
Greenfields	Generally rural land identified to be urbanised over time.
Hydroperiod	Flow and/or soil saturation period of streams or wetlands.
Project Area	Area of land that is within the proposed designation boundary.
Project Footprint	Area of land that is within the road design.
Significant Ecological Area	An overlay within the Auckland Unitary Plan Operational in Part, whereby areas of terrestrial, freshwater or marine habitat of significant indigenous vegetation or significant habitats of indigenous fauna are identified and protected from the adverse effects of subdivision, use or development.
Wetland	Defined in the Resource Management Act 1991 as “includes permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions”.
Zone of Influence	The Zone of Influence is defined in the EIANZ Guidelines as “the areas/resources that may be affected by the biophysical changes caused by the proposed Project and associated activities.”
Rapid Habitat Assessment	The RHA provides a standardised protocol for making a quick, qualitative, site-based assessment of physical stream habitat conditions (Clapcott, 2015).

1 Executive Summary

This Ecological Impact Assessment (EcIA) has been prepared for the Te Tupu Ngātahi Supporting Growth Alliance, Warkworth Package of Notices of Requirement (NORs) for Auckland Transport (AT) and Waka Kotahi NZ Transport Agency (WK) as requiring authorities under the Resource Management Act 1991 (RMA) (Table 1-1). The notices are to designate land for future strategic transport corridors as part of Te Tupu Ngātahi Supporting Growth Alliance to enable the future construction, operation and maintenance of transport infrastructure in the Warkworth area of Auckland.

Table 1-1 Warkworth Package – Notices of Requirement and Projects

Notice	Project
NOR 1	Northern Public Transport Hub and Western Link - North
NOR 2	Woodcocks Road Upgrade (Western Section)
NOR 3	State Highway 1 Upgrade - South
NOR 4	Matakana Road Upgrade
NOR 5	Sandspit Road Upgrade
NOR 6	Western Link - South
NOR 7	Sandspit Link
NOR 8	Wider Western Link – North

As the Warkworth Package relates to proposed designations, this EcIA assesses district plan matters only. Regional matters (along with Wildlife Act (1953) compliance) will be subject to a future consenting phase along with a supporting EcIA. As such, regional matters have not been formally assessed in this report, however the relevant matters have been screened to inform the designation boundary and future regional resource consents.

In order to inform the ecological baseline, ecological features within each Notice of Requirement (NOR) boundary were identified, mapped and their value assessed in terms of representativeness, rarity/distinctiveness, diversity/pattern and ecological context. A summary of the ecological values are provided for terrestrial vegetation (Table 1-2), terrestrial fauna (Table 1-3), streams (Table 1-4) and wetlands (Table 1-5).

Table 1-2 Ecological values of terrestrial vegetation types for each NOR

Vegetation Type	Classification *	NOR 1	NOR 2	NOR 3	NOR 4	NOR 5	NOR 6	NOR 7	NOR 8
Brown Field	BF	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Exotic Forest	EF	-	-	-	-	Moderate	-	-	-
Exotic Grassland	EG	Low	Low	Low	Low	Low	Low	Low	Low
Exotic Scrub	ES	Low	Low	Low	-	Low	Low	-	-
Kahikatea Forest	MF4	-	-	-	High	High	-	High	-
Planted Vegetation – Native (recent)	PL.1	-	Moderate	Moderate	Low	Low	Moderate	Low	-
Planted Vegetation - Native (mature)	PL.2	-	Low	Low	Low	-	-	-	Low
Planted Vegetation – Amenity	PL.3	-	Low	Low	Low	Low	-	Low	Low
Treeland – Native-Dominated	TL.1	-	-	Moderate	Low	-	-	Moderate	-
Treeland – Mixed Native/Exotic	TL.2	-	High	Moderate	Moderate	High	-	-	-
Treeland – Exotic-Dominated	TL.3	-	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Low
Kānuka Scrub/Forest	VS2	-	-	Moderate	Moderate	High	-	-	High
Pūriri Forest	WF7	-	-	-	-	-	-	-	High

Vegetation Type	Classification *	NOR 1	NOR 2	NOR 3	NOR 4	NOR 5	NOR 6	NOR 7	NOR 8
Pūriri Forest (alluvial terraces with recent free-draining soils)	WF7.1	-	-	-	-	Very High	-	High	-
Kauri, Podocarp, Broadleaved Forest	WF11	-	High	-	-	High	-	High	-
Tawa, Kohekohe, Rewarewa, Hīnau, Podocarp Forest	WF13	-	-	-	Very High	-	-	-	-

Notes: * = Classification as per Singers et al. (2017).

Table 1-3 Ecological values of terrestrial fauna for each NOR

Fauna Type	Ecological Value	Relevant NOR
Mammals		
Long-tailed bat	Very High	All NORs
Avifauna		
Non-TAR birds	Low	All NORs
New Zealand pipit	High	All NORs
Long-tailed cuckoo	Very High	NOR 2, NOR 4, NOR 5, NOR 7, NOR 8
North Island kākā	High	NOR 2, NOR 4, NOR 5, NOR 7, NOR 8
Black shag, little black shag, pied shag, little shag	High	NOR 2, NOR 7
Australasian bittern	Very High	NOR 1, NOR 3, NOR 4, NOR 5, NOR 6, NOR 7, NOR 8

Fauna Type	Ecological Value	Relevant NOR
Spotless crake	High	NOR 1, NOR 3, NOR 4, NOR 5, NOR 6, NOR 7, NOR 8
Dabchick	Very High	NOR 8
Herpetofauna		
Copper skink	High	All NORs
Ornate skink	High	NOR 2, NOR 4, NOR 5, NOR 7, NOR 8
Elegant gecko	High	NOR 2, NOR 4, NOR 5, NOR 7, NOR 8
Forest gecko	High	NOR 2, NOR 4, NOR 5, NOR 7, NOR 8
Pacific gecko	Moderate	NOR 2, NOR 4, NOR 5, NOR 7, NOR 8
Hochstetter's frog	High	NOR 4, NOR 5, NOR 7

Table 1-4 Ecological values of directly impacted streams for each NOR

Stream ID	NOR 1	NOR 2	NOR 3	NOR 4	NOR 5	NOR 6	NOR 7	NOR 8
WW2-S4	-	Low	-	-	-	-	-	-
WW3-S2a	-	-	Moderate	-	-	-	-	-
WW3-S2b	-	-	Moderate	-	-	-	-	-
WW3-S3a	-	-	Moderate	-	-	-	-	-
WW3-S3b	-	-	Moderate	-	-	-	-	-
WW3-S4a	-	-	Moderate	-	-	-	-	-

Stream ID	NOR 1	NOR 2	NOR 3	NOR 4	NOR 5	NOR 6	NOR 7	NOR 8
WW3-S4b	-	-	Moderate	-	-	-	-	-
WW4-S1	-	-	-	Low	-	-	-	-
WW4-S2	-	-	-	Low	-	-	-	-
WW4-S3	-	-	-	Low	-	-	-	-
WW5-S1	-	-	-	-	High	-	-	-
WW5-S3	-	-	-	-	Low	-	Low	-
WW5-S4	-	-	-	-	Low	-	-	-
WW5-S5	-	-	-	-	Low	-	-	-
WW5-S6	-	-	-	-	Low	-	-	-
WW7-S2b	-	-	-	-	-	-	Low	-
WW7-S3a	-	-	-	-	-	-	Moderate	-
WW7-S5	-	-	-	-	-	-	Low	-
WW8-S1	-	-	-	-	-	-	-	Moderate
WW8-S2	-	-	-	-	-	-	-	Moderate

Table 1-5 Ecological values of directly impacted wetlands for each NOR

Wetland	NPS-FM	NOR 1	NOR 2	NOR 3	NOR 4	NOR 5	NOR 6	NOR 7	NOR 8
WW2-W2	Natural	-	Low	-	-	-	-	-	-

Wetland	NPS-FM	NOR 1	NOR 2	NOR 3	NOR 4	NOR 5	NOR 6	NOR 7	NOR 8
WW3-W3	Natural	-	-	Moderate	-	-	-	-	-
WW3-W4	Natural	-	-	Moderate	-	-	-	-	-
WW3-W5	Natural	-	-	Low	-	-	-	-	-
WW4-W1	Natural	-	-	-	Moderate	-	-	-	-
WW4-W2	Natural	-	-	-	Moderate	-	-	-	-
WW4-W3	Natural	-	-	-	Low	-	-	-	-
WW5-W1	Natural	-	-	-	-	Low	-	-	-
WW5-W3	Natural	-	-	-	-	Low	-	-	-
WW6-O2	Artificial	-	-	-	-	-	Low	-	-
WW7-W3	Natural	-	-	-	-	-	-	Moderate	-
WW7-W4	Natural	-	-	-	-	-	-	Low	-
WW7-W5	Natural	-	-	-	-	-	-	Low	-
WW7-W6	Natural	-	-	-	-	-	-	Low	-
WW7-W7	Natural	-	-	-	-	-	-	Low	-
WW8-W1	Natural	-	-	-	-	-	-	-	Moderate
WW8-W2	Natural	-	-	-	-	-	-	-	Low
WW8-W4	Natural	-	-	-	-	-	-	-	Moderate

Construction Effects

Table 1-6 to Table 1-7 provides a summary of district matter ecological effects during construction prior to any mitigation. The summary represents the level of effect for the baseline and the likely future ecological environment as one where they are the same and with an asterisk (*) where they differ. Where the level of effect was assessed to be **Moderate** or higher, then mitigation has been developed.

Construction effect mitigation measures will include:

- A Bat Management Plan (BMP) for NOR 2, NOR 4, NOR 5, NOR 7, and NOR 8 should be developed to include consideration for:
  - Surveys prior to construction to confirm presence/likely absence. Surveys to confirm bat roost locations if activity is confirmed.
  - Confirmation of maternity roosts may require a seasonal restriction on construction activity (no or restricted construction during Dec-Mar).
  - Siting of compounds and laydown areas to avoid bat habitat.
  - Lighting design to reduce light levels and spill from construction areas.
  - Restriction of nightworks around bat habitat.
  - Bat management should be incorporated with any regional consent conditions (i.e., BMPs) that may be required for regional compliance.
- An Avifauna Management Plan (AMP) for all NORs should be developed to include consideration for:
  - New Zealand pipit (all NORs)
    - Pre-construction nesting bird surveys in suitable habitat (EG, ES).
    - Timing consideration for construction works (avoiding breeding season, where practicable).
    - Methods to minimise disturbance if the breeding season cannot be avoided.
  - Spotless crake (all NORs excluding NOR 2)
    - Pre-construction nesting bird surveys at specific wetland habitat.
    - Timing consideration for construction works (avoiding breeding season, where practicable).
    - Methods to protect and buffer nesting birds (if present).
  - Dabchick (NOR 8)
    - Pre-construction nesting bird surveys at wetland WW8-W1.
    - Timing consideration for construction works (avoiding breeding season, where practicable).
    - Methods to protect and buffer nesting birds (if present).

Table 1-6 Summary of ecological effects during construction prior to mitigation for long-tailed bats

	Construction – Long-tailed bats
NOR	**Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust, vibration etc.)**
NOR 1	Low
NOR 2	**Moderate**
NOR 3	Low
NOR 4	**Moderate**

	Construction – Long-tailed bats
NOR 5	**Moderate**
NOR 6	Low
NOR 7	**Moderate**
NOR 8	**Moderate**

Notes: * = Indicates a level of effect associated with the Likely Future Ecological Environment that is different from the baseline level of effects.

Table 1-7 Summary of ecological effects during construction prior to mitigation for avifauna

	Construction – Avifauna
NOR	**Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc.)**
NOR 1	
Non-TAR birds	Very Low
New Zealand pipit	**High** *Very Low
Australasian bittern	Low
Spotless crake	**Moderate**
NOR 2	
Non-TAR birds	Very Low
New Zealand pipit	**High** *Very Low
North Island kākā	Very Low
Long-tailed cuckoo	Low
Black shag, little black shag, little shag, pied shag	Very Low
NOR 3	
Non-TAR birds	Very Low
New Zealand pipit	**High** *Very Low
Australasian bittern	Low
Spotless crake	**Moderate**

	Construction – Avifauna
NOR 4	
Non-TAR birds	Very Low
New Zealand pipit	**High** *Very Low
North Island kākā	Very Low
Long-tailed cuckoo	Low
Australasian bittern	Low
Spotless crake	**Moderate**
NOR 5	
Non-TAR birds	Very Low
New Zealand pipit	**High** *Very Low
North Island kākā	Very Low
Long-tailed cuckoo	Low
Australasian bittern	Low
Spotless crake	**Moderate**
NOR 6	
Non-TAR birds	Very Low
New Zealand pipit	**High** *Very Low
Australasian bittern	Low
Spotless crake	**Moderate**
NOR 7	
Non-TAR birds	Very Low
New Zealand pipit	**High** *Very Low
North Island kākā	Very Low
Long-tailed cuckoo	Low
Black shag, little black shag, little shag, pied shag	Very Low

	Construction – Avifauna
Australasian bittern	Low
Spotless crake	**Moderate**
NOR 8	
Non-TAR birds	Very Low
New Zealand pipit	**High** *Very Low
North Island kākā	Very Low
Long-tailed cuckoo	Low
Australasian bittern	Low
Spotless crake	**Moderate**
Dabchick	**Moderate**

Notes: * = Indicates a level of effect associated with the Likely Future Ecological Environment that is different from the baseline level of effects.

Table 1-8 Summary of ecological effects during construction prior to mitigation for herpetofauna

	Construction – Herpetofauna
NOR	**Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc.)**
NOR 1	
Copper skink	Low *Very Low
NOR 2	
Copper skink, ornate skink	Very Low
Elegant gecko, forest gecko	Low *Very Low
Pacific gecko	Low *Very Low
NOR 3	
Copper skink	Very Low
NOR 4	

	Construction – Herpetofauna
Copper skink, ornate skink	Very Low
Elegant gecko, forest gecko	Low *Very Low
Pacific gecko	Low *Very Low
Hochstetter's frog	Very Low
NOR 5	
Copper skink, ornate skink	Very Low
Elegant gecko, forest gecko	Low *Very Low
Pacific gecko	Low *Very Low
Hochstetter's frog	Low
NOR 6	
Copper skink	Very Low
NOR 7	
Copper skink, ornate skink	Low *Very Low
Elegant gecko, forest gecko	Low *Very Low
Pacific gecko	Low *Very Low
Hochstetter's frog	Low *Very Low
NOR 8	
Copper skink, ornate skink	Low *Very Low
Elegant gecko, forest gecko	Low *Very Low
Pacific gecko	Low

	Construction – Herpetofauna
	*Very Low

Notes: * = Indicates a level of effect associated with the Likely Future Ecological Environment that is different from the baseline level of effects.

The residual (post-mitigation) level of effect for all construction effects are considered **Negligible** to **Low**.

Operational Effects

Table 1-9 to Table 1-11 provides a summary of district matter ecological effects during operation prior to any mitigation. The summary represents the level of effect for the baseline and the likely future ecological environment as one where they are the same and with an asterisk (*) where they differ. Where the level of effect was assessed to be **Moderate** or higher, then mitigation has been developed.

Operational effect mitigation measures will include:

- A Bat Management Plan (BMP) for NOR 2, NOR 3, NOR 4, NOR 5, NOR 7, and NOR 8 should be developed to include consideration for:
  - Indicative early-stage/mature buffer planting, late-stage buffer planting, and retention of existing mature trees between the road alignment and features with potential for bat roosts as outlined in the indicative bat mitigation in Appendix 12.
  - Light and noise management through design.
  - Future presence of roosts within the alignment (placement of flaps on features with high roost potential).
  - Assumptions in the efficacy of the proposed mitigation will be addressed through an adaptive management framework that will outline bat activity thresholds, robust monitoring, and potential corrective action.
- An Avifauna Management Plan (AMP) for all NORs should be developed to include consideration for:
  - Spotless crake (all NORs excluding NOR 2)
    - Retention of vegetation near wetland habitat, where practicable.
    - Buffer planting between the road alignment and suitable habitat adjacent to the road.
  - Dabchick (NOR 8)
    - Retention of vegetation near wetland habitat, where practicable.
    - Buffer planting between the road alignment and suitable habitat adjacent to the road.

Table 1-9 Summary of ecological effects during operation prior to mitigation for long-tailed bats

Operation – Long-tailed bats		
NOR	**Disturbance and displacement of (new and existing) roosts and individuals due to the presence of the road (noise, vibration, light etc.)**	**Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape**
NOR 1	Low	Low

Operation – Long-tailed bats		
NOR 2	**Moderate**	**High**
NOR 3	Very Low	**Moderate**
NOR 4	Low	**Moderate**
NOR 5	Low	**Moderate**
NOR 6	Low	Low
NOR 7	**Moderate**	**Moderate**
NOR 8	**Moderate**	**Very High** ***High**

Notes: * = Indicates a level of effect associated with the Likely Future Ecological Environment that is different from the baseline level of effects.

Table 1-10 Summary of ecological effects during operation prior to mitigation for avifauna

Operation – Avifauna		
NOR	**Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)**	**Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure**
NOR 1		
Non-TAR birds	Very Low	Very Low
New Zealand pipit	Very Low	Very Low
Australasian bittern	Low	Low
Spotless crake	**Moderate**	Very Low
NOR 2		
Non-TAR birds	Very Low	Very Low
New Zealand pipit	Very Low	Very Low
North Island kākā	Very Low	Very Low
Long-tailed cuckoo	Low	Low
Black shag, little black shag, little shag, pied shag	Very Low	Very Low
NOR 3		
Non-TAR birds	Very Low	Very Low

Operation – Avifauna		
New Zealand pipit	Very Low	Very Low
Australasian bittern	Low	Low
Spotless crake	**Moderate**	Very Low
NOR 4		
Non-TAR birds	Very Low	Very Low
New Zealand pipit	Very Low	Very Low
North Island kākā	Very Low	Very Low
Long-tailed cuckoo	Low	Low
Australasian bittern	Low	Low
Spotless crake	**Moderate**	Very Low
NOR 5		
Non-TAR birds	Very Low	Very Low
New Zealand pipit	Very Low	Very Low
North Island kākā	Very Low	Very Low
Long-tailed cuckoo	Low	Low
Australasian bittern	Low	Low
Spotless crake	**Moderate**	Very Low
NOR 6		
Non-TAR birds	Low *Very Low	Very Low
New Zealand pipit	Low *Very Low	Very Low
Australasian bittern	Low	Low
Spotless crake	**Moderate**	Very Low
NOR 7		
Non-TAR birds	Low *Very Low	Low *Very Low
New Zealand pipit	Very Low	Very Low
North Island kākā	Very Low	Very Low

Operation – Avifauna		
Long-tailed cuckoo	Low	Low
Black shag, little black shag, little shag, pied shag	Very Low	Very Low
Australasian bittern	Low	Low
Spotless crake	**Moderate**	Very Low
NOR 8		
Non-TAR birds	Low *Very Low	Very Low
New Zealand pipit	Very Low	Very Low
North Island kākā	Very Low	Very Low
Long-tailed cuckoo	Low	Low
Australasian bittern	Low	Low
Spotless crake	**Moderate**	Low
Dabchick	**Moderate**	Low

Notes: * = Indicates a level of effect associated with the Likely Future Ecological Environment that is different from the baseline level of effects.

Table 1-11 Summary of ecological effects during operation prior to mitigation for herpetofauna

Operation – Herpetofauna		
NOR	**Disturbance and displacement of existing and future herpetofauna due to the presence of the road (noise, vibration, light etc.)**	**Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure**
NOR 1		
Copper skink	Very Low	Very Low
NOR 2		
Copper skink, ornate skink	Very Low	Very Low
Elegant gecko, forest gecko	Low *Very Low	Very Low
Pacific gecko	Low	Very Low

Operation – Herpetofauna		
	*Very Low	
NOR 3		
Copper skink	Very Low	Very Low
NOR 4		
Copper skink, ornate skink	Very Low	Very Low
Elegant gecko, forest gecko	Very Low	Very Low
Pacific gecko	Very Low	Very Low
Hochstetter's frog	Very Low	Very Low
NOR 5		
Copper skink, ornate skink	Very Low	Very Low
Elegant gecko, forest gecko	Very Low	Very Low
Pacific gecko	Very Low	Very Low
Hochstetter's frog	Very Low	Low *Very Low
NOR 6		
Copper skink	Very Low	Very Low
NOR 7		
Copper skink, ornate skink	Low *Very Low	Low *Very Low
Elegant gecko, forest gecko	Low *Very Low	Low
Pacific gecko	Low *Very Low	Low
Hochstetter's frog	Low *Very Low	Low
NOR 8		
Copper skink, ornate skink	Low *Very Low	Low *Very Low

Operation – Herpetofauna		
Elegant gecko, forest gecko	Low *Very Low	Low *Very Low
Pacific gecko	Low *Very Low	Low *Very Low

Notes: * = Indicates a level of effect associated with the Likely Future Ecological Environment that is different from the baseline level of effects.

The residual (post-mitigation) level of effect for all operational effects are considered **Negligible** to **Low**.

2 Introduction

This Ecological Impact Assessment (EcIA) has been prepared for the Te Tupu Ngātahi Supporting Growth Alliance, Warkworth Package of Notices of Requirement (NORs) for Auckland Transport (AT) and Waka Kotahi NZ Transport Agency (WK) as requiring authorities under the Resource Management Act 1991 (RMA). The notices are to designate land for future strategic transport corridors as part of Te Tupu Ngātahi Supporting Growth Alliance to enable the future construction, operation and maintenance of transport infrastructure in the Warkworth area of Auckland.

2.1 Warkworth Growth Area

Warkworth is located at the northernmost extent of the Auckland Region, approximately 60 km from the Auckland city centre, and 30 km north of Orewa. It is identified as a satellite town in the Auckland Unitary Plan: Operative in Part (AUP:OP) and will act as a rural node that serves both the surrounding rural communities as well as connecting to urban Auckland.

The Warkworth growth area will be less than 5 km north-south and east-west and will make a significant contribution to the future growth of Auckland's population. A 1000 ha of currently rural land has been rezoned (Future Urban Zone) to support significant business and residential growth. At full build out it is anticipated to provide for approximately 8,200 new dwellings and employment activities that will contribute to 4,600 new jobs across Warkworth. This growth area will be development ready in the stages outlined below:

- **Stage 1** Warkworth North – Business land is already live zoned and remainder to be development ready by 2022.
- **Stage 2** Warkworth South – To be development ready between 2028 – 2032.
- **Stage 3** Warkworth Northeast – To be development ready between 2033 – 2037.

Furthermore, the Warkworth Structure Plan was adopted by the Council in 2019 and sets out the framework for transforming Warkworth from a rural environment to an urbanised community over the next 15 - 20 years.

It is noted that parts of these areas are experiencing earlier than anticipated growth pressure, with parts of Warkworth South subject to a lodged Private Plan Change, as well as sections of Warkworth Northeast[1].

The Warkworth Assessment Package will provide route protection for the local arterials, which include walking, cycling and public transport linkages needed to support the expected growth in Warkworth. The Warkworth Package of projects is summarised in Section 2.

This report addresses the ecological effects of the Warkworth Package (NOR 1 - NOR 8) identified in Table 2-1 below

Refer to the Assessment of Effects on the Environment (AEE) for a more detailed project description.

[1] https://www.aucklandcouncil.govt.nz/have-your-say/have-your-say-notified-resource-consent/Pages/resource-consent-public-notice.aspx?itemId=194&src=Search

Table 2-1 Warkworth Assessment Package – Notices of Requirement and Projects

Notice	Project
NOR 1	Northern Public Transport Hub and Western Link - North
NOR 2	Woodcocks Road Upgrade (Western Section)
NOR 3	State Highway 1 Upgrade – South
NOR 4	Matakana Road Upgrade
NOR 5	Sandspit Road Upgrade
NOR 6	Western Link - South
NOR 7	Sandspit Link
NOR 8	Wider Western Link – North

2.2 Purpose and Scope of this Report

This ecological assessment forms part of the suite of technical reports prepared to support the assessment of effects (AEE) for the Warkworth Package. Its purpose is to inform the AEE that accompanies the eight Warkworth Network NORs.

This report considers the actual and potential effects associated with the construction, operation, and maintenance of the Warkworth Package on the existing and likely future environment as it relates to ecological effects and recommends measures that may be implemented to avoid, remedy and/or mitigate these effects.

The key matters addressed in this report are as follows:

a) Identify and describe the ecological context of the Warkworth Assessment Package area;
b) Identify and describe the actual and potential ecological effects (as they relate to district matters) of each Project corridor within the Warkworth Assessment Package;
c) Recommend measures as appropriate to avoid, remedy or mitigate actual and potential ecological effects (including any conditions/management plan required) for each Project corridor within the Warkworth Assessment Package; and
d) Present an overall conclusion of the level of actual and potential effects for each Project corridor within the Warkworth Assessment Package after recommended measures are implemented.

This report should be read alongside the AEE, which contains further details on the history and context of the Warkworth project. The AEE also contains a detailed description of works to be authorised within each NOR, and the typical construction methodologies that will be used to implement this work. These have been reviewed by the author of this report and have been considered as part of this assessment of ecological effects. As such, they are not repeated here. Where a description of an activity is necessary to understand the potential effects, it has been included in this report for clarity.

2.3 Report Structure

In order to provide a clear assessment of each NOR, this report follows as appropriate, the structure set out in the AEE. That is, the network as a whole as well as the individual corridors and facilities have their own section, and each section contains an assessment of the actual and potential effects. Where appropriate, measures to avoid, remedy or mitigate effects are recommended.

The sections are arranged starting from the overall network, then by project form starting from Public Transport Hubs, then existing road upgrades, and finally new corridors. Table 2-2 below describes the extent of each corridor, and where the description of effects can be found in this report.

Table 2-2 Warkworth Assessment Package – Report Structure

Sections	Section number
Description of the Project	Section 2
Assessment Approach	Section 3
Overview of the methodology used to undertake the assessment and identification of the assessment criteria and any relevant standards or guidelines	Section 4
Ecological Baseline for all Warkworth NORs	Section 5
Positive ecological effects of the Warkworth project	Section 6
Identification and description of the existing and likely receiving ecological environment	Section 3
Assessment of specific ecological matters for Warkworth NOR 1: Northern Public Transport Interchange + Park and Ride and Western Link (Northern Section)	Section 7
Assessment of specific ecological matters for Warkworth NOR 2: Woodcocks Road Upgrade (Western Section)	Section 8
Assessment of specific ecological matters for Warkworth NOR 3: State Highway 1 Upgrade (Southern Section)	Section 9
Assessment of specific ecological matters for Warkworth NOR 4: Matakana Road Upgrade	Section 10
Assessment of specific ecological matters for Warkworth NOR 5: Sandspit Road Upgrade	Section 11
Assessment of specific ecological matters for Warkworth NOR 6: Western Link - South	Section 12
Assessment of specific ecological matters for Warkworth NOR 7: Sandspit Link	Section 13
Assessment of specific ecological matters for Warkworth NOR 8: Wider Western Link (Northern Section)	Section 14
Cumulative ecological effects of the Warkworth project	Section 15
Design and Future Resource Consent Considerations	Section 16
Overall conclusion of the level of potential adverse ecological effects of the Warkworth Project	Section 17

2.4 Warkworth Package Overview

The Warkworth package is a network of planned transport infrastructure with the purpose of responding to planned future growth in the Warkworth growth areas. The transport network is made of eight NORs including public transport interchanges, existing road upgrades, and new corridors.

An overview of the Warkworth NOR package is set out in Table 2-3 and shown in Figure 2-1.

Table 2-3 Warkworth Assessment Package – Notices of Requirement (NORs)

Corridor	NOR	Description	Requiring Authority
Northern Public Transport Hub and Western Link – North	1	New northern public transport hub and associated facilities including a park and ride at the corner of State Highway 1 (SH1) and the new Western Link – North. New urban arterial cross-section with active mode facilities between the intersection of SH1 and Te Honohono ki Tai (Matakana Link Road) to the proposed bridge crossing, enabling a connection for development in the Warkworth Northern Precinct as provided for in the Warkworth North Precinct.	Auckland Transport
Woodcocks Road - West	2	Upgrade of the existing Woodcocks Road corridor between Mansel Drive and Ara Tūhono (Puhoi to Warkworth) to an urban arterial cross-section with active mode facilities.	Auckland Transport
State Highway 1 – South Upgrade	3	Upgrade of the existing SH1 corridor between Fairwater Road and the southern Rural Urban Boundary to an urban arterial cross-section with active mode facilities.	Auckland Transport
Matakana Road Upgrade	4	Upgrade of the existing Matakana Road corridor between the Hill Street intersection and the northern Rural Urban Boundary to an urban arterial cross-section with active mode facilities.	Auckland Transport
Sandspit Road Upgrade	5	Upgrade of the existing Sandspit Road corridor between the Hill Street intersection and the eastern Rural Urban Boundary to an urban arterial cross-section with active mode facilities.	Auckland Transport
Western Link – South	6	New urban arterial cross-section with active mode facilities between the intersection of SH1 and McKinney Road and Evelyn Street.	Auckland Transport
Sandspit Link	7	New urban arterial cross-section with active mode facilities between the intersection of Matakana Road and Te Honohono ki Tai (Matakana Link Road) and Sandspit Road.	Auckland Transport

Corridor	NOR	Description	Requiring Authority
Wider Western Link – North	8	New urban arterial cross-section with active mode facilities between Woodcocks Road and the Mahurangi River.	Auckland Transport

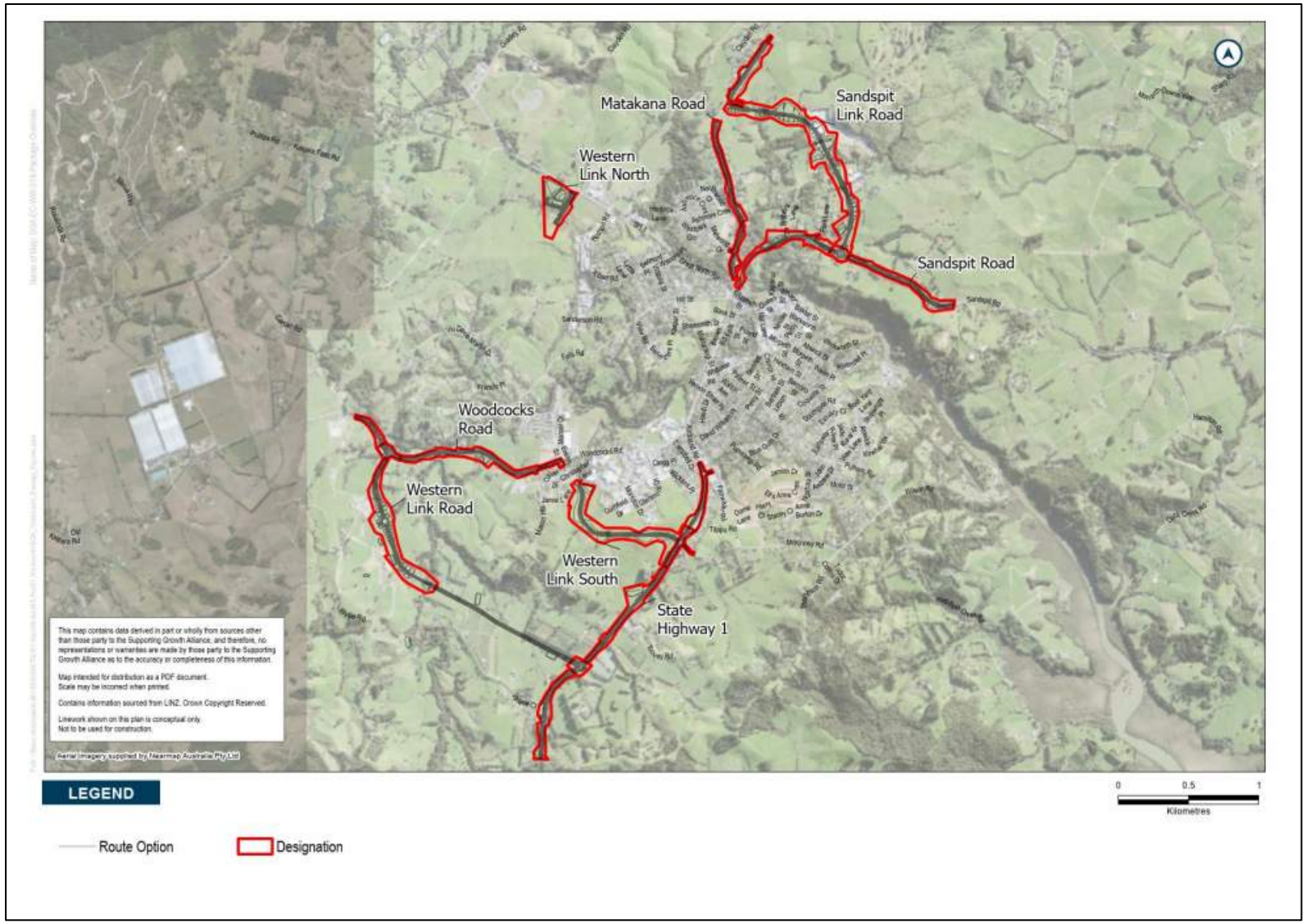

Figure 2-1 Warkworth NOR package overview

3 Assessment Approach

3.1 Existing and Likely Future Environment

The projects encompassing the Warkworth NOR package are likely to be constructed 15-20 years from now. The implementation timeframe for each project will vary and correspond with future land release within the area. Assessing the effects on the environment solely as it exists today (i.e., at the time of assessment) will not provide an accurate reflection of the environment in which some of the effects will be experienced. Accordingly, the assessment of effects considers both the existing environment, and the likely receiving environment in which the effects will likely occur.

The Warkworth NOR package will be constructed and will operate alongside existing urban environments or planned future environments (i.e. what can be built under the existing Auckland Unitary Plan: Operative in Part (AUP:OP) and what is identified in the Warkworth Structure Plan):

1. **Existing environment**: A number of corridors comprising the Warkworth NOR package are partially located within/alongside existing urban areas.

    a) Matakana Road Upgrade – residential land uses (single house zone, mixed housing suburban zone, mixed housing urban zone) comprise the western and north-western extents of the corridor.
    b) Western Link - South – residential land uses are situated to the north and northwest of the corridor and existing industrial land use on the eastern extent of the corridor.
    c) State Highway 1 (Southern Section) – residential land uses are adjacent to the northwest and southeast of the northern extent of the corridor, additionally there are established business land uses to the northeast of the northern extent of the corridor.
    d) Woodcocks Road – the eastern extent of the corridor has existing residential land uses to the north and south.

2. **Future environment**: All the corridors in the Warkworth NOR package will partially or wholly be constructed and implemented on land identified for future growth (future urban zone) and as a result are anticipated to change to urban or industrial land uses.

The likelihood and magnitude of land use change regarding the land use planning context has been identified in Table 3-1 below. This has been used to inform the assumptions made on the likely future environment

Table 3-1 Likelihood and magnitude of land use change

Existing environment	Current AUP:OP Zoning	Likelihood of Change for the environment[2]	Magnitude of potential change	Likely Receiving Environment[3]
Residential[4]	Residential (Mixed Housing Suburban)	Low	Low	Residential

[2] Based on AUP:OP zoning/policy direction
[3] Based on Warkworth Structure Plan and AUP:OP zoning/policy direction

Existing environment	Current AUP:OP Zoning	Likelihood of Change for the environment[2]	Magnitude of potential change	Likely Receiving Environment[3]
	Residential (Mixed Housing Urban)	Low	Low	Residential
	Residential (Single House)	Low	Low	Residential
Business	Business (Mixed Use)	Low	Low	Business (Industrial)
	Business (General Business)			Business (General Business)
	Business (Light Industry)	Low	Low	Business (Industrial)
	Business (Local Centre Zone)	Low	Low	Business (Neighbourhood Centre)
Open Space	Open Space – Conservation Zone	Low	Low	Informal Recreation
Greenfield areas	Future Urban Zone	High	High	Urban
Other	Special Purpose – Quarry Zone	Low	Med	Quarry

3.1.1 Existing and Likely Future Ecological Environment

Refer to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the overall Warkworth package.

Table 3-2 below provides a summary of the existing and likely future environment as it relates to each of the NORs.

Table 3-2 Existing and likely future environment for each NOR

Environment today	NOR	Zoning	Likelihood of Change for the Environment	Likely Future Environment	Implications of Future Environment on Ecological Features
Business	1, 3	FUZ	Low	Business	All ecological features are likely to remain similar or the same. Vegetation cover, streams, and wetland features are likely to be relatively unchanged.
Urban	2, 3, 4	FUZ		Urban	
Open Space - Conservation	2, 5, 7	Open Space - Conservation		Open Space - Conservation	
Special Purpose	7	Special Purpose		Special Purpose (Quarry)	
Undeveloped greenfield areas (rural)	1, 2, 3, 6	FUZ	High	Urban	As land is developed, the majority of terrestrial vegetation (such as planted vegetation, forestry and shelterbelts outside riparian and wetland features, but adjacent to the NOR) will be cleared and developed. However, these features may be present during the construction phase of the road (depending on the time difference between road construction and urban development). Streams, wetlands, and riparian vegetation is likely to be retained and potentially locally improved through protection within esplanade reserves and habitat enhancement. Habitat connectivity may be reduced as road crossings and urbanisation fragment the catchment.
Undeveloped greenfield areas (rural)	6	Business		Business	
Rural	4, 5, 7, 8	FUZ		Urban	

3.1.2 Permitted Activities and the Likely Future Ecological Environment

The areas of existing undeveloped greenfields are zoned FUZ in the AUP:OP, and as such are planned for urbanisation. Vegetation clearance within the FUZ, excluding habitat for TAR species, vegetation within 10 m of a riparian strip, and tree removal (excluding district plan vegetation), are identified as permitted activities within Chapters E26 and E15 of the AUP:OP. As such the ecological features (i.e., terrestrial habitat), excluding natural inland wetlands, streams, and riparian edges, which are currently present adjacent to the NOR, will likely be removed by future development, and will not be present when the new and upgraded transport corridors are operational (albeit we have assumed they will still be present during construction). Subsequently, our effects assessment has taken this into account.

3.2 EcIA Assessment

The approach followed in this study is consistent with the approach outlined in the Ecological Impact Assessment (EcIA) Guidelines (Roper Lindsay et al., 2018) (hereinafter referred to as the EIANZ Guidelines). The overarching goal of the ecological assessment is to determine the ecological effects of specific Project features or activities. The requirements for such an assessment are outlined with the EIANZ Guidelines and forms the basis of this report. This process is summarised in Figure 3-1 below. Note that for the impact management (Stage 3) additional consideration was given to the permitted baseline and the future environment under the AUP.

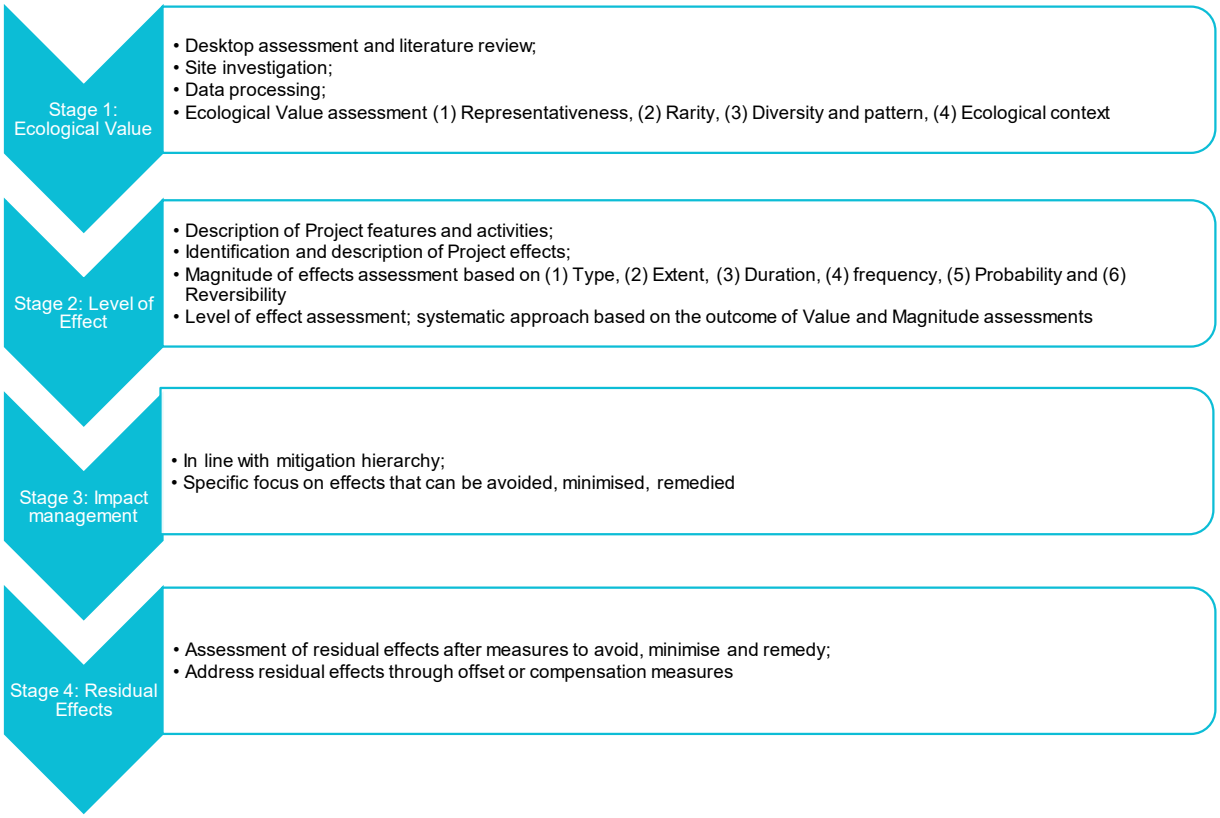

Figure 3-1 Approach process followed for this assessment

3.2.1 EcIA and the Likely Future Ecological Environment

The EIANZ Guidelines provide guidance to assist with the assessment of the likely future ecological environment in this report. The assessment states:

"The ecologist needs to consider the permitted baseline in order to describe the potential "future ecological environment and to assess effects at that time, and should discuss this with the project planner or legal advisor if in any doubt".

The Warkworth Project Team has advised of the following to inform the assessment of the likely future environment:

- The purpose of the NORs is to protect the transport corridors that will support the future urbanisation of Warkworth. Construction and operation of the new and upgraded corridors will not occur until urbanization has at least been confirmed by way of a plan change or is under development.
- In addition, the AUP:OP permits activities for infrastructure, which will also change the likely future environment. These activities include vegetation clearance and the removal of trees, excluding notable trees and street trees. The relevant permitted activities for ecology provisions are set out in Appendix 2.
- Given the planned urbanization of Warkworth, assessing the effects on the environment solely as it exists today (i.e., at the time of ecological site investigation/the preparation of this ecology assessment) will not provide an accurate reflection of the environment in which ecological effects, resulting from the construction and operation of each of the NORs, will be experienced.

- The assessment of ecological effects should therefore take account of the likely future environment, which takes account of permitted activities for infrastructure and planned urbanisation within the FUZ.

3.3 Assessment of District Plan Matters and Approach to Regional Matters

Designations are a form of 'spot zoning' over a route in a district plan. The designation authorises Waka Kotahi or AT, as the relevant requiring authority, to undertake work and activity without the need for land use consent. The designated area is still subject to restrictions on land use under regional matters in the AUP:OP.

As the Warkworth Assessment Package relates to proposed designation this assessment of ecological effects assesses district plan matters only. Regional matters will be subject to a future consenting phase along with a supporting ecological impact assessment (EcIA). As such regional matters have not been formally assessed in this report, however the relevant matters have been screened to inform the alternative assessments, designation boundary and the future regional resource consents (presented in Section 16).

Appendix 3 sets out the split between District and Regional matters in the AUP:OP

3.4 Wildlife Act Matters

The Wildlife Act (1953) includes specific provisions for activities that may disturb, injure, or kill native animals. Construction and operational activities that may require consideration under the Wildlife Act are outlined in Appendix 3. The scope of this report pertains to district matters and although not required for NORs, further consideration has been given to ecological effects under the Wildlife Act in Section 16. Construction and operational activities that may require consideration under the Wildlife Act are outlined in Appendix 3.

4 Assessment Methodology

Desktop and site investigations were undertaken for ecological features within all eight NORs. Ecological features within the proposed designation boundary and a distance of approximately 100 m radius[5] of the designation have been mapped and included in this assessment. Terrestrial, stream, and wetland features were investigated and mapped to provide context for potential adjustments to the proposed designation boundary. In addition to the area including into the ecological mapping, potential habitat for native fauna was considered within the Zone of Influence (ZOI) (see Section 4.1).

4.1 Zone of Influence

The ZOI of the Project relates to an area occupied by habitats and species that are adjacent to and may go beyond the boundary of the Project Area. It is defined in the EIANZ Guidelines as "the areas/resources that may be affected by the biophysical changes caused by the proposed Project and associated activities." The distance of the ZOI and type of effect from the Project can be different for different species and habitat types. The ZOI is used throughout this report to describe the impacts of the Project (construction and operational) on adjacent or connected terrestrial, freshwater, and wetland habitats and associated native species. For example, all Significant Ecological Areas (SEAs) within 2 km of each Project Area has been included in the desktop review, along with their connectivity to each Project Area. This is to ensure that important habitat within the wider landscape has been taken into consideration and can be used to inform the potential for flora and fauna to be present within each of the Project Areas and whether the Project ZOI extends out to these SEAs.

The ZOI of the Project on different species differs depending on how individual species use their environment e.g., mobile species such as long-tailed bats have a larger home range and more diverse habitat requirements compared to lizards and threatened plant species which may be restricted to a small area or specific habitat type. This affects how a species could be impacted by the Project and this was taken into consideration during the desktop review and site investigations. To reflect the likelihood of a species occurring or dispersal ability within the Project Area, varying search distances were used depending on the species context.

4.2 Desktop Review

A desktop review of existing ecological records was undertaken to gain an understanding of the species and habitats that could be present within the ZOI of each of the NORs.

The sources of information that were reviewed to determine the likelihood of a species or habitat occurring within or adjacent to each of the Project Areas include:

- Auckland Council GeoMaps[6];
- Department of Conservation (DOC) Bioweb records[7];
- Department of Conservation Threat Classification Series[8];

[5] The designation boundary has undergone several rounds of refinement. The ecological mapping was undertaken on the initial designation boundary and is considered sufficiently wide to provide a contingency for relatively small adjustment during refinement. The 100 m area mapping was included to provide additional context regarding the nature and extent of ecological features (including wetlands).

[6] https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html

[7] https://www.doc.govt.nz/our-work/monitoring-reporting/request-monitoring-data/

[8] All Department of Conservation Threat Classification Documents are listed in the below webpage. When individual reports are referenced hereafter, they are referenced in-text and in Section 12. https://www.doc.govt.nz/about-us/science-publications/conservation-publications/nz-threat-classification-system/

- Ecological Regions and Districts of New Zealand (McEwen, 1987);
- iNaturalist records[9], records within approximately 2-5 km buffer of the NORs;
- Indigenous terrestrial and wetland ecosystems of Auckland (Singers et al., 2017);
- National Institute of Water and Atmospheric Research (NIWA) freshwater fish database[10];
- New Zealand Bird Atlas eBird database[11]; recorded within 10 km^2 grid squares. Results from grid squares W66 and W67;

4.3 Site Investigations

Site investigations[12] were undertaken in order to:

- Prepare an ecological baseline of terrestrial, freshwater, and wetland ecology;
- Inform the assessment of each of the NORs against the relevant district matters (terrestrial ecology);
- Set out freshwater and wetland matters which may be considered as part of a future regional resource consent, or under relevant wildlife legislation;
- Inform the designation footprint.

4.3.1 Terrestrial Habitat

Site walkovers were undertaken between November 2022 and December 2022 by ecologists; to map and describe the habitats present within and adjacent to each of the eight NORs. Habitats were classified into ecosystem type based on those described in Singers et al. (2017). The habitats were also assessed as to their potential to support indigenous fauna, including long-tailed bats, avifauna, and herpetofauna.

Habitat assessment focused on areas of potentially significant value, such as habitat that was identified as an SEA, classified as forest habitat on Auckland Council's Geomaps – Ecosystems Current Extent (Singers et al., 2017) or appears to be wetland or forest habitat based on aerial photos and during site investigation. Species records from relevant literature and biodiversity databases were used to focus search efforts on certain areas within the Project Areas.

During the site walkovers the vegetation assessment included recording the dominant or characteristic species present and the general quality described, including structure, maturity, presence of weeds and evidence of grazing and foliar dieback. Vegetation surveys also included searches for any rare or threatened plant species previously recorded within the Project Areas.

Common plant names are predominantly used within this report. Maps showing the vegetation cover along the NORs are provided in Appendix 5.1. Terrestrial ecological value assessment methodology is discussed in Section 4.4.

4.3.2 Freshwater Habitat

Where access allowed, streams within the Project Area identified on Auckland Council Geomaps ('Named Streams') were ground-truthed and classified as permanent, intermittent, or ephemeral,

[9] https://www.inaturalist.org/

[10] https://nzffdms.niwa.co.nz/search

[11] https://ebird.org/atlasnz/home

[12] Not all features were subject to a site investigation due to access constraints. Features assessed at desktop level are identified throughout the report.

according to the stream definitions described by Storey & Wadhwa (2009). Any additional streams observed during site walkovers were also classified. Streams are mapped in Appendix 5.1.2.

Freshwater assessments were undertaken on all streams identified on site and included stream classification and implementation of the Rapid Habitat Assessment (RHA) protocol and were undertaken by experienced ecologists. The RHA provides a standardised protocol for making a quick, qualitative, site-based assessment of physical stream habitat conditions (Clapcott, 2015). Stream Ecological Valuation (SEV) assessments were not undertaken but are expected to be included during the regional resource consenting phase. As such, macroinvertebrate and fish surveys were not undertaken as part of this assessment. However, New Zealand Freshwater Fish Database (NZFFD) records (Stoffels, 2022) were used to inform potential ecological value of streams. Access was restricted at several locations and as such some stream assessments were based solely on desktop information. Freshwater ecological value assessment methodology is discussed in Section 4.4.

4.3.3 Wetland Habitat

Potential wetland habitat areas were identified by ecologists based on Auckland Council Geomaps contours and the presence of wetland vegetation on aerial maps Including a review of historical images). Potential wetlands were mapped and where access permitted, verified through the use of the rapid technique outlined in wetland delineation protocol (Ministry for the Environment, 2020). Because the wetland delineation predominantly relied on desktop assessment, a more conservative delineation was adopted. Ambiguous areas were assumed to be wetlands. Wetland areas are mapped in Appendix 5.1.2.

Note that the scope of the specialist study, for route protection, did not provide for a detailed wetland delineation. The key focus was to confirm wetland presence and approximate extent. This approach is considered practical for the purposes of route protection, as the level of design is limited to what is necessary for route protection. It is expected that a detailed design will occur in the future which will confirm actual design and subsequent potential impacts, therefore a more detailed wetland assessment will be undertaken during the regional resource consenting phase.

Wetlands were assessed based on the RMA definition of a wetland[13] and classified into ecosystem type based on those described in Singers et al. (2017). If the habitat present met this definition, it was then further evaluated against the provisions of the NPS-FM for natural inlands wetlands (assessed for potential exclusion on the basis of being artificial or pasture dominated). Details regarding the wetland value assessment is outlined in Section 4.4.

4.4 Ecological Value Assessment

The ecological value of each ecological feature (terrestrial, freshwater and wetland) was assessed using a spreadsheet template by assigning a score of 0 (None), 1 (Low), 2 (Moderate), 3 (High) or 4 (Very High) based on professional judgement (with justification) to attributes associated with each of the four ecological matters recommended within EIANZ (2018): (1) Representativeness 2) Rarity/distinctiveness 3) Diversity and pattern 4) Ecological context including. Considerations in relation to the four matters and corresponding aspects for terrestrial, freshwater and wetland features are detailed below:

[13] "wetland includes permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions"

4.4.1 Terrestrial Ecology

1) **Representativeness**: Typical structure, species composition and indigenous representation
2) **Rarity/distinctiveness**: Species of conservation significance, distinctive ecological values
3) **Diversity and pattern**: Habitat diversity, species diversity and patterns in habitat use
4) **Ecological context**: Size, shape and buffering function, sensitivity to change, ecological networks (linkages, pathways, migration)

4.4.2 Freshwater Ecology

1) **Representativeness**: RHA score for accessible sites and riparian habitat modification based on desktop stream and catchment assessments
2) **Rarity/distinctiveness**: Species of conservation significance informed by the potential occurrence of Threatened and At-Risk (TAR) fish species
3) **Diversity and pattern**: Level of natural diversity informed by the habitat diversity subsection of the RHA. Stream order, slope and hydroperiod were applied as desktop proxies to judge the likely habitat diversity for streams where access was constraint
4) **Ecological context**: Stream order and hydroperiod

4.4.3 Wetland Ecology

1) **Representativeness**: Hydrological modification based on observations of drains, ponds and catchment land use. Native vegetation informed by site visit and review of landcover information;
2) **Rarity/distinctiveness**: Wetland type (rare or distinctive); distinctive ecological values (ecosystem services) in a larger catchment context;
3) **Diversity and pattern**: Representation of different hydroperiods (permanent, seasonal or temporary) and the structural complexity of vegetation cover
4) **Ecological context**: flood attenuation, streamflow regulation, sediment trapping, water purification, connectivity and migration

4.4.4 Fauna

Notwithstanding the ecological value associated with vegetation/habitat units, specific consideration still needs to be given to individual species and their conservation significance for the following reasons (in accordance with EIANZ Guidelines):

- The habitat value may dilute the conservation value associated with specific species. For example, if the combined value for exotic grassland is **Low**, while the value for copper skink (At Risk - Declining) is **High**. The combined value of **Low** therefore understates the conservation value of the species;
- Species may not be restricted to a single vegetation unit;
- Potential effects on species are unrelated to habitat units. For example, impact on highly mobile species (such as bats) by noise and light may be independent of the habitat loss associated with the Project footprint.
- Consideration and adjustment of ecological value may occur dependent on regional threat status and local knowledge (if available). The more conservative of the ecological values should be used.

For the reasons outlined above, the ecological value assessments for individual species are defined by their conservation significance.

5 Ecological Baseline

5.1 Historical Ecological Context

All eight NORs are located within the Rodney Ecological District (ED). This ED is characterised by low altitude, warm humid summers and mild winters, and weakly leached, fertile soils with good drainage formed under hardwood forest (McEwen, 1987). Originally forested, the landscape near the current Warkworth town centre would have been dominated by broadleaved forest with abundant pūriri with occasional tōtara, matai, kahikatea and titoki. In the surrounding Warkworth area, the landscape would have been dominated by kauri, podocarp, broadleaved forest (Singers et al., 2017).

Presently, most of the ED is highly modified with only 18% indigenous land cover of the native land cover remain in the ED (Lindsay et al., 2009). The extent of remaining native vegetation cover in the Project Area is mostly restricted to Significant Ecological Areas (SEAs) or reduced to fragmented remnant vegetation or regenerating vegetation following historical clearance.

5.2 Terrestrial Habitat and Fauna

5.2.1 Terrestrial Vegetation

Where natural habitat remains, the AUP:OP has mapped and classified habitats as terrestrial or marine SEAs. SEAs which occur within 2 km of the eight NORs are presented in Appendix 11. A distance of 2 km was selected as potential ZOI for adverse effects of the Project depending on the potential receiving environment and the habitats and species present with a SEA. Mapping of terrestrial vegetation is presented in Appendix 5.

Table 5-1 Description of the terrestrial vegetation types present within the Project Area

Habitat	Classification*	Description of Habitat
Brown Field (includes cropland)	BF	This definition includes Industrial zones, metaled carparks, rail corridors, unmanaged or managed land within urban settings, road median strips, pavements, cracks in concrete. Substrate includes metal (stone chip) and concrete surfaces. largely exotic herbfield (weeds) and occasional exotic or native woody species. For the purposes of mapping this has been extended to include bare ground associated with cropland, market gardens and construction sites.
Exotic Forest	EF	Forest vegetation with >50% cover of exotic species in the canopy. Generally used to describe single species forestry plantations. This level of distinction was used for desktop habitat assessment where the understory vegetation was not assessed.
Exotic Grassland	EG	Grassland dominated by exotic species. This includes pasture, garden lawns and sport pitches.
Exotic Scrub	ES	Exotic secondary scrub or shrubland with >50% cover/biomass of exotic species. The future trajectory is uncertain. Dominant species include gorse, woolly nightshade and privet species.
Kahikatea Forest	MF4	Mostly remnant Kahikatea swamp forest dominant constrained to SEA_T_6684 and within and adjacent to SEA_T_5440.
Planted Vegetation – Native (recent)	PL.1	Native restoration plantings with <50% exotic biomass. Recently planted native scrub and forest <20 years old.
Planted Vegetation - Native (mature)	PL.2	Native restoration plantings with <50% exotic biomass. Mature planted native scrub and forest >20 years old.
Planted Vegetation – Exotic (amenity)	PL.3	Exotic amenity plantings. This includes planted exotic vegetation within parks, amenity areas and private gardens.
Treeland – Native-Dominated	TL.1	Tree canopy cover 20-80%: Native-dominated: >75% native tree cover. For the purposes of mapping this includes planted and wilding native vegetation and mature shelterbelts. This includes mature riparian vegetation and scattered or discontinuous canopy of mature trees within gardens, farms, and amenity areas.
Treeland – Mixed Native/Exotic	TL.2	Tree canopy cover 20-80%. Mixed native/exotic: with 25-75% native tree cover. For the purposes of mapping this includes planted and wilding exotic vegetation and mature shelterbelts. This includes mature riparian vegetation and scattered or discontinuous canopy of mature trees within gardens, farms, and amenity areas.
Treeland – Exotic-Dominated	TL.3	Tree canopy cover 20-80%: <25% native with exotic tree cover dominant. For the purposes of mapping this includes planted and wilding exotic vegetation and mature shelterbelts. This includes mature

Habitat	Classification*	Description of Habitat
		riparian vegetation and scattered or discontinuous canopy of mature trees within gardens, farms, and amenity areas.
Kānuka Scrub/Forest	VS2	Kānuka-dominated forest with insufficient emergent secondary species to determine trajectory to mature forest type. Occurs on hillslopes, ridges, terraces, and plains especially on free-draining soils. Species include kānuka (*Kunzea ericoides*), *Coprosma* spp. *and Pittosporum* spp.
Pūriri Forest	WF7	Remnant/regenerating pūriri, tōtara forest. Occurs on recent alluvial terraces and floodplain/river valleys. Secondary successions dominated by podocarp trees, notably totara.
Pūriri Forest (alluvial terraces with recent free-draining soils)	WF7.1	Same as WF7 but mostly constrained to alluvial terraces.
Kauri, Podocarp, Broadleaved Forest	WF11	Mostly constrained to specific SEAs, but some remnant patches present outside of SEAs. Exotic species present on canopy margins and understory. No or very few kauri present in remnant patches. Broadleaved species and kahikatea common in the gullies. Generally, only gully component of this ecosystem type remains with few kauri.
Tawa, Kohekohe, Rewarewa, Hīnau, Podocarp Forest	WF13	Tawa and kohekohe most dominant canopy species. exotic species present on canopy margins and understory Kauri absent. Mostly constrained to SEAs.

Notes: * = Classification as per Singers et al. (2017).

Table 5-2 summaries the vegetation types, classification (Singers et al., 2017) and ecological value associated with each NOR.

Appendix 6 presents the detailed ecological value for terrestrial vegetation identified in the Project Area.

District plan vegetation e.g., road trees, open space trees, notable trees have been considered and identified in the Assessment of Arboricultural Effects Report (as defined in Table E26.4.3.1 in Appendix 2). Ecological effects related to the removal of these trees is considered **Negligible** (with the exception of NOR 4) and as such have not been considered any further in this ecological effects assessment. In NOR 4, district plan vegetation located in the southern area of NOR 4, on the western side of the existing Matakana Road may provide low quality habitat to long-tailed bats, elegant, forest, and pacific geckos, and Non-TAR birds. Therefore, this area of district plan vegetation requires vegetation removal mitigation as per Section 16.1.

Additionally, there are three locations (NOR 2, 4, and 5 – refer Appendix 11) where an Open Space overlay (District Plan matter) interacts with a SEA overlay (Regional Plan matter) in the AUP:OP. The ecological effects of the removal of these areas of SEA vegetation are considered to be a regional consenting matter and as such have been considered and discussed further as part of the wider SEA vegetation removal considerations in Section 16.1.

Table 5-2 Terrestrial vegetation types present within the Project Area and their ecological value

Vegetation Type	Classification*	NOR 1	NOR 2	NOR 3	NOR 4	NOR 5	NOR 6	NOR 7	NOR 8
Brown Field	BF	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Exotic Forest	EF	-	-	-	-	Moderate	-	-	-
Exotic Grassland	EG	Low	Low	Low	Low	Low	Low	Low	Low
Exotic Scrub	ES	Low	Low	Low	-	Low	Low	-	-
Kahikatea Forest	MF4	-	-	-	High	High	-	High	-
Planted Vegetation – Native (recent)	PL.1	-	Moderate	Moderate	Low	Low	Moderate	Low	-
Planted Vegetation - Native (mature)	PL.2	-	Low	Low	Low	-	-	-	Low
Planted Vegetation – Amenity	PL.3	-	Low	Low	Low	Low	-	Low	Low
Treeland – Native-Dominated	TL.1	-	-	Moderate	Low	-	-	Moderate	-
Treeland – Mixed Native/Exotic	TL.2	-	High	Moderate	Moderate	High	-	-	-
Treeland – Exotic-Dominated	TL.3	-	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Low
Kānuka Scrub/Forest	VS2	-	-	Moderate	Moderate	High	-	-	High
Pūriri Forest	WF7	-	-	-	-	-	-	-	High

Vegetation Type	Classification*	NOR 1	NOR 2	NOR 3	NOR 4	NOR 5	NOR 6	NOR 7	NOR 8
Pūriri Forest (alluvial terraces with recent free-draining soils)	WF7.1	-	-	-	-	Very High	-	High	-
Kauri, Podocarp, Broadleaved Forest	WF11	-	High	-	-	High	-	High	-
Tawa, Kohekohe, Rewarewa, Hīnau, Podocarp Forest	WF13	-	-	-	Very High	-	-	-	-

Notes: * = Classification as per Singers et al. (2017).

5.2.2 Long-tailed bats

Existing desktop records (Department of Conservation, 2022) confirm the presence of long-tailed bats (*Chalinolobus tuberculatus*) within 5 km of the NORs (Figure 5-1 and Figure 5-2). There are bat records within 3 km to the west of NOR 1, near Dome Valley, and within 1.6 km to the west of NOR 3, within SEA_T_2367 adjacent to Wylie Road. Subsequently, no bat surveys were undertaken for this Project.

The conservation status of this species is 'Threatened - Nationally Critical' (O'Donnell et al., 2017), therefore the ecological value of long-tailed bats is **Very High** if they are likely to be present. Table 5-3 presents the potential bat habitat areas for each NOR based on the results of the desktop review and potential habitat surveys.

Table 5-3 Results of desktop review and potential habitat surveys for long-tailed bats within the Project Area

NOR	Desktop Records within ZOI	Potential bat habitat e.g., bat roost potential, foraging potential
NOR 1	Yes – 3.0 km	N/A
NOR 2	Yes – 2.3 km	Riparian habitat associated with Mahurangi River, and habitat associated with Significant Ecological Area SEA_T_6676.
NOR 3	Yes – 3.5 km	N/A
NOR 4	Yes – 4.3 km	Habitat associated with Significant Ecological Area SEA_T_5440 and SEA_T_2260
NOR 5	Yes – 4.3 km	Habitat associated with Significant Ecological Area SEA_T_6684 and SEA_T_5440. Mature trees on 89 and 163 Sandspit Rd.
NOR 6	Yes – 2.7 km	N/A
NOR 7	Yes – 4.3 km	Mature trees associated with WF11 habitat.
NOR 8	Yes – 1.6 km	Riparian trees associated with Mahurangi River.

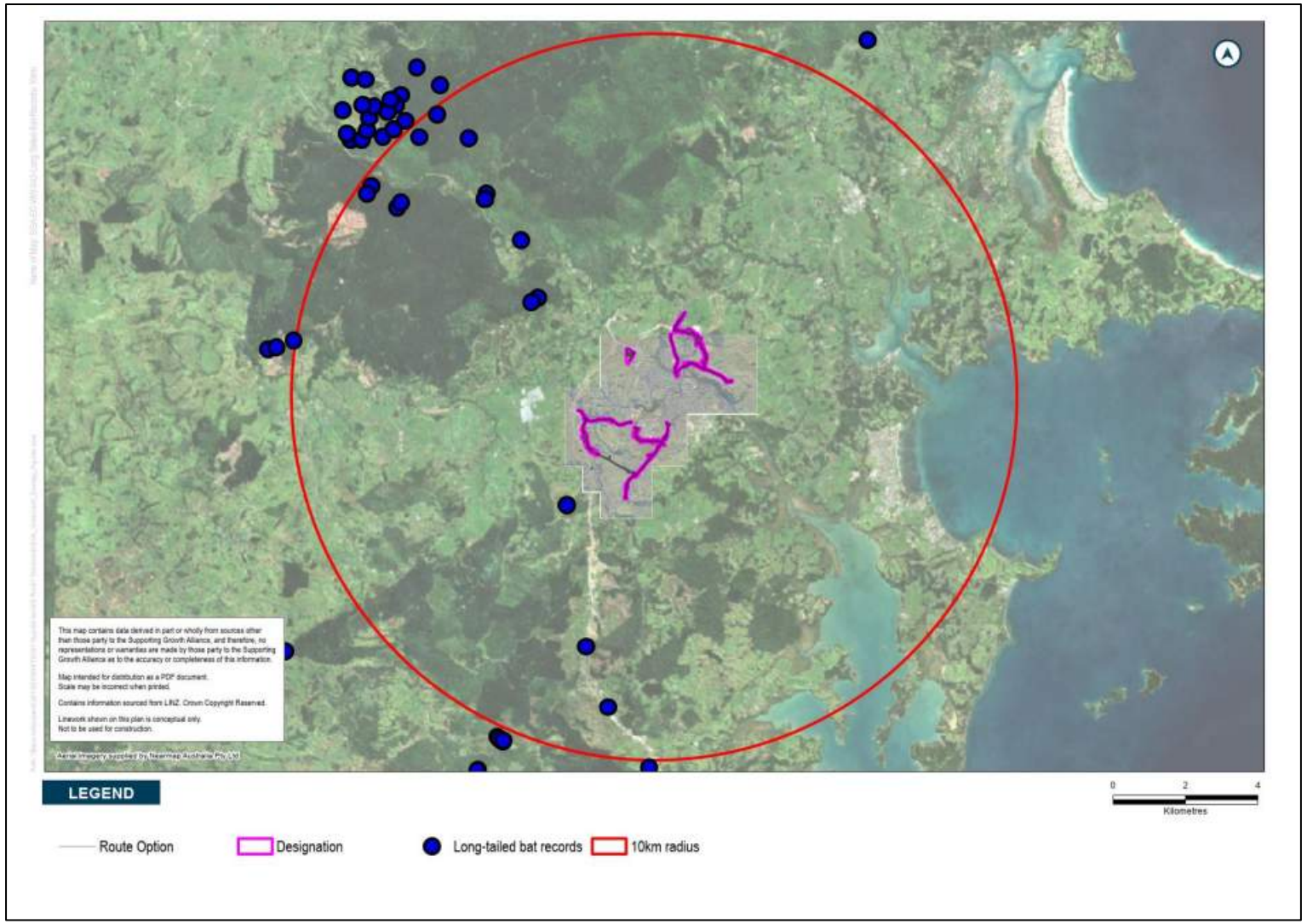

Figure 5-1 Long-tailed bat records within 10 km radius of the Project Area

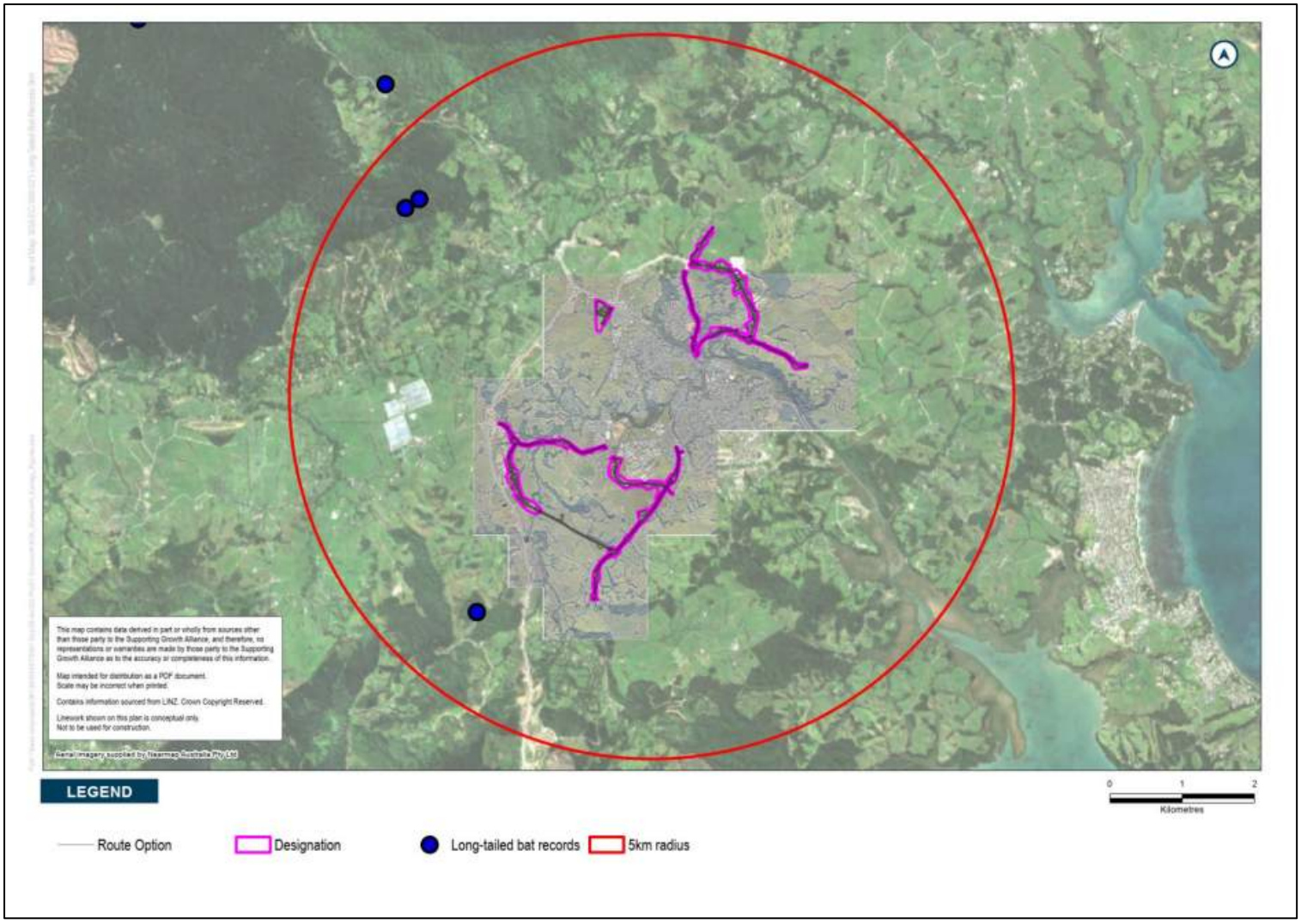

Figure 5-2 Long-tailed bat records within 5 km radius of the Project Area

5.2.3 Avifauna

An area wide desktop review identified 89 forest, freshwater, and coastal bird species (59 of which are native) within a 2 km buffer of the Project Area. A full list of species identified in this desktop review is included in Appendix 4.

No dedicated bird surveys were undertaken for the Project; however, incidental observations of birds were recorded during site visits. A full list of incidental observations is also included in Appendix 4. Additionally, a desktop assessment identified potential habitat for a number a TAR species, which is detailed in Table 5-4.

Table 5-4 details all the observed and potential TAR bird species for each NOR, including the ecological value for each species[14].

[14] Non-threatened native bird species are considered to have a **Low** ecological value. The full list of bird species identified via desktop assessment and incidental observations are included in Appendix 4.

Table 5-4 TAR bird species observed or likely to occur within suitable habitat in the Project Area

Species	Conservation Status (Robertson et al., 2021)	Record Source	Distribution and Habitat	Project Area Habitat	Ecological Value	Relevant NOR
Australasian bittern/Matuku-hūrepo (*Botaurus poiciloptilus*)	Threatened – Nationally Critical	eBird (Bird Atlas)	Found throughout New Zealand and can travel long distances. Commonly use raupō-fringed lakes, spring-fed creeks with cover and areas of rank-grass along paddock/drain edges (Williams, 2013).	Has the potential to utilise wetland habitat in all NORs (excluding NOR 2) for foraging. No breeding or nesting sites observed.	Very High	NOR 1, NOR 3, NOR 4, NOR 5, NOR 6, NOR 7, NOR 8
Black shag/Māpunga (*Phalacrocorax carbo novaehollandiae*)	At Risk - Relict	eBird (Bird Atlas)	Widespread throughout New Zealand (but sparsely so). Utilise habitats such as coastal waters, estuaries, harbours, rivers, streams, lakes and ponds (Powlesland, 2013).	Has the potential to utilise freshwater habitat present in NOR 2 and NOR 7. No breeding or roosting sites observed.	High	NOR 2, NOR 7
Dabchick/Weweia (*Poliocephalus rufopectus)*	Threatened – Nationally Increasing	eBird (Bird Atlas)	Small shallow freshwater lakes and ponds, with dense marginal vegetation. Uncommon but widespread in the Auckland region (Szabo, 2013).	Has the potential to utilise freshwater habitat in the planted wetland (PLW) for foraging and breeding in NOR 8.	Very High	NOR 8

Species	Conservation Status (Robertson et al., 2021)	Record Source	Distribution and Habitat	Project Area Habitat	Ecological Value	Relevant NOR
Little black shag/Kawau tūī (*Phalacrocorax sulcirostris*)	At Risk – Naturally Uncommon	• eBird (Bird Atlas) • iNaturalist	Occur in coastal inlets, lakes and ponds, including stormwater ponds. Roosting and breeding in overhanging trees. Common and widespread in the Auckland region (Armitage, 2013).	Has the potential to utilise freshwater habitat present in NOR 2 and NOR 7. No breeding or roosting sites observed.	High	NOR 2, NOR 7
Little shag/Kawaupaka (*Phalacrocorax melanoleucos brevirostris*)	At Risk - Relict	• eBird (Bird Atlas) • iNaturalist	Widespread across New Zealand. Likely to utilise coastal habitat, lakes, rivers, ponds, and streams (Taylor, 2013).	Has the potential to utilise freshwater habitat present in NOR 2 and NOR 7. No breeding or roosting sites observed.	High	NOR 2, NOR 7
Long-tailed cuckoo/Koekoeā (*Eudynamys taitensis*)	Threatened - Nationally Vulnerable	Assumed present based on suitable habitat present in NOR 2, NOR 4, NOR 5, NOR 7, and NOR 8.	Summer migrant to New Zealand, spending winter in tropical Pacific islands. As a parasite nester, their range is restricted to host species whitehead, brown creeper and yellowhead. Absent as a breeding species from Auckland region (except Te Hauturu-o-Toi, Little Barrier Island) but occur on migration passage	Has the potential to briefly occur on migration passage across the Project Area. Can occur in native/exotic forest, scrub, farmland, or urban areas on passage to breeding/winter habitat.	Very High	NOR 2, NOR 4, NOR 5, NOR 7, NOR 8

Species	Conservation Status (Robertson et al., 2021)	Record Source	Distribution and Habitat	Project Area Habitat	Ecological Value	Relevant NOR
			throughout New Zealand (Gill, 2013).			
New Zealand pipit/Hīoi (*Anthus novaeseelandiae*)	At Risk – Declining	eBird (Bird Atlas)	Occur in open habitat such as coastal and alpine grasslands, but also utilise modified landscapes such as pasture and scrub within the rural landscape. Rare but widespread in the Auckland region (Beauchamp, 2013).	Has the potential to utilise any open habitat such as Exotic Grassland and Exotic Scrub for foraging and breeding in all NORs.	High	All NORs
North Island kākā (*Nestor meridionalis septentrionalis*)	At Risk – Recovering	eBird (Bird Atlas)	Kākā are generally restricted to indigenous forest habitat and offshore islands in the Auckland region. However, they make seasonal migrations to the Auckland mainland, particularly in winter where they often utilize exotic pine and eucalyptus trees in rural and urban areas. Rare but widespread (seasonal migrant) in the Auckland region (Moorhouse, 2013).	Has the potential to utilise any mature treeland, exotic forest, or mature indigenous forest types. There is no breeding habitat within the NORs, but likely to infrequently utilise exotic trees for seasonal foraging and roosting throughout winter season.	High	NOR 2, NOR 4, NOR 5, NOR 7, NOR 8

Species	Conservation Status (Robertson et al., 2021)	Record Source	Distribution and Habitat	Project Area Habitat	Ecological Value	Relevant NOR
Pied shag/Kāruhiruhi (*Phalacrocorax varius*)	(At Risk – Recovering)	• eBird (Bird Atlas) • iNaturalist	Occur in coastal inlets, lakes and ponds, including stormwater ponds. Roosting and breeding in overhanging trees. Common and widespread in the Auckland region (Powlesland, 2013).	Has the potential to utilise freshwater habitat present in NOR 2 and NOR 7. No breeding or roosting sites observed.	High	NOR 2, NOR 7
Spotless crake/Pūweto (*Porzana tabuensis plumbea*)	At Risk – Declining	Assumed present based on suitable habitat present in all NORs.	Wetland vegetation and freshwater lakes and ponds, with dense marginal vegetation. Rare but widespread in the Auckland region (Fitzgerald, 2013).	Has the potential to utilise any moderate or larger wetland habitat areas (>1000 m2) for foraging and breeding in all NORs (except NOR 2).	High	NOR 1, NOR 3, NOR 4, NOR 5, NOR 6, NOR 7, NOR 8

5.2.4 Herpetofauna

Existing desktop records (Department of Conservation, 2022) confirm the presence of native herpetofauna within 5 km of the Project Area. No dedicated lizard surveys were undertaken for the Project, however opportunistic searches were conducted where possible. Table 5-5 details all of the observed and potential native herpetofauna species for each NOR, including the ecological value for each species.

Table 5-5 Native herpetofauna likely to occur within suitable habitat in the Project Area

Species	Conservation Status (Hitchmough et al., 2021; Burns et al., 2017)	Record Source	Distribution and Habitat (New Zealand Herpetological Society, 2022)	Project Area Habitat	Ecological Value	Relevant NOR
Copper skink *(Oligosoma aeneum)*	At Risk – Declining	DOC Bioweb records	Widespread from just south of the Aupouri Peninsula through to Wellington. Frequently recorded within highly modified habitats such as exotic scrub and rank grassland.	Anticipated to occur within all habitats where there is suitable understorey, excluding Brown Field (BF).	High	All NORs
Elegant gecko *(Oligosoma aeneum)*	At Risk – Declining	DOC Bioweb records	Northern North Island from just south of the Bay of Islands, through to Taranaki, and the Bay of Plenty. Utilise forested habitats, including swamps, scrubland, and mature forest.	Anticipated to occur within areas of MF4, VS2, WF7, WF7.1, WF11, and WF13 that are present in the Project Area.	High	NOR 2, NOR 4 NOR 5, NOR 7, and NOR 8
Forest gecko *(Oligosoma aeneum)*	At Risk – Declining	DOC Bioweb records	Northern North Island from just south of the Bay of Islands, through to Taranaki, and the Bay of Plenty. Also found in the north-western South Island from the Marlborough, Tasman, and West Coast regions. Utilise swamps, scrubland, mature forests (beech, podocarp, and broadleaf), and rock fields.	Anticipated to occur within areas of MF4, VS2, WF7, WF7.1, WF11, and WF13 that are present in the Project Area.	High	NOR 2, NOR 4, NOR 5, NOR 7, and NOR 8

Species	Conservation Status (Hitchmough et al., 2021; Burns et al., 2017)	Record Source	Distribution and Habitat (New Zealand Herpetological Society, 2022)	Project Area Habitat	Ecological Value	Relevant NOR
Ornate skink *(Oligosoma ornatum)*	At Risk – Declining	Assumed present based on suitable habitat present in NOR 2, NOR 4, NOR 5, NOR 7, and NOR 8.	Widespread throughout the North Island, however populations are sparse. Utilise forested areas, shrubland and heavily vegetated coastlines; found amongst leaf litter, in dense low foliage, thick rank grass and under rocks or logs.	Anticipated to occur within all habitats contiguous to native forest or scrub and where there is suitable understorey, excluding Brown Field (BF)	High	NOR 2, NOR 4, NOR 5, NOR 7, and NOR 8
Pacific gecko	Not Threatened	Assumed present based on suitable habitat present in NOR 2, NOR 4, NOR 5, NOR 7, and NOR 8.	Widespread throughout the northwestern North Island. Utilise swamps, scrubland, mature forests, rocky coastlines, back-dunes, rocky islets, and rock outcrops.	Anticipated to occur within areas of MF4, VS2, WF7, WF7.1, WF11, and WF13 that are present in the Project Area.	Moderate[15]	NOR 2, NOR 4, NOR 5, NOR 7, and NOR 8
Hochstetter's frog *(Leiopelma hochstetteri)*	At Risk - Declining	DOC Bioweb records	Restricted to the North Island, occurring in discrete populations. Semi-aquatic species that are typically found in small streams in pine forests, mature podocarp/broadleaf forests, regenerating scrubland, seepages in banks, and in ditches adjacent to forested areas.	Anticipated to occur within specific permanent streams in NOR 4, NOR 5, and NOR 7.	High	NOR 4, NOR 5, and NOR 7

[15] Although the national conservation status for pacific gecko is 'Not Threatened', the species is assigned a Moderate ecological value as the regional conservation status of pacific gecko in Auckland is 'Regionally Declining' (Melzer et al., 2022).

5.2.5 Invertebrates

Kauri snail (*Paryphanta* spp.) (At Risk – Declining) (Mahlfeld et al., 2012) were identified in the desktop review. Five 'research grade' observations of kauri snail were recorded on iNaturalist in Parry Kauri Park, approximately 1 km east of NOR 3. Additionally, suitable habitat has been identified in the Project Area for flax snails (*Placostylus* spp.), large land snails (*Powelliphanta* spp.), and Auckland tree wētā (*Hemideina thoracica*). It is likely that these invertebrate species are present in NOR 2 (Woodcocks Road Upgrade), NOR 4 (Matakana Road Upgrade), and NOR 7 (Sandspit Link) due to the presence of native forest and dense leaf litter in these NORs.

It is considered that Project effects on kauri snail, flax snails, large land snails, and Auckland tree wētā are less than **Negligible**, as it is not anticipated that these invertebrates will respond to noise, light, vibration, and dust, and also due to their very small home range. Therefore, these invertebrate species have not been assessed further in this report. However, impact management will be required under the Wildlife Act to prevent killing or injuring these species. This is detailed further in Section 16.

5.3 Freshwater Habitat and Fauna

5.3.1 Streams

A review of the NZ River Name Lines dataset (LINZ, 2022) indicated that Woodcocks Road Upgrade (NOR 2), and Wider Western Link (Northern Section (NOR 8) will cross named rivers/streams (Table 5-6). Various tributaries of the Mahurangi River, Mahurangi River (Left Branch), and Mahurangi River (Right Branch) will also be crossed in the Project Area (excluding New Western Link - South (6)), and these are detailed further in Table 5-7.

A total of 38 streams within the Project Area designation boundary were identified and assessed. Additionally, all streams that were accessed during site investigations were surveyed using the Rapid Habitat Assessment (RHA), the detailed RHA results are included in Appendix 10. Table 5-8 details streams in the Project Area, and their corresponding ecological value.

Stream mapping is presented in Appendix 5, and Appendix 7 presents the detailed ecological value for streams identified in the Project Area.

Table 5-6 Named rivers/streams that will be crossed Project wide (LINZ, 2022)

Relevant NOR	River/Stream Name
NOR 2: Woodcocks Road Upgrade	Mahurangi River (Left Branch)
	Mahurangi River (Right Branch)
NOR 8: Wider Western Link (Northern Section)	Mahurangi River (Right Branch)

Table 5-7 Unnamed rivers/streams that will be crossed Project wide (LINZ, 2022)

Relevant NOR	River/Stream Name
NOR 1: Northern Public Transport Hub + Park and Ride and Western Link North (Northern Section)	Mahurangi River unnamed tributary
NOR 2: Woodcocks Road Upgrade	Mahurangi River (Left Branch) unnamed tributary
NOR 3: State Highway 1 (Southern Section) Upgrade	Mahurangi River (Right Branch) unnamed tributaries
NOR 4: Matakana Road Upgrade	Mahurangi River unnamed tributaries
NOR 5: Sandspit Road Upgrade	Mahurangi River unnamed tributaries
NOR 7: Sandspit Link	Mahurangi River unnamed tributaries

Table 5-8 Summary of streams identified in the Project Area and their ecological value

Stream Name	Stream ID	Hydroperiod	RHA Category	Ecological Value	Relevant NOR
Unnamed tributary (Mahurangi River catchment)	WW1-S1*	Permanent	N/A	Low	NOR 1
Mahurangi River tributary	WW1-S2*	Permanent	N/A	Moderate	NOR 1
Mahurangi River (Left Branch)	WW2-S1	Permanent	Good	High	NOR 2
Mahurangi River (Left Branch) tributary	WW2-S2^	Permanent	Moderate	Moderate	NOR 2
Mahurangi River (Right Branch)	WW2-S3^	Permanent	Good	High	NOR 2
Unnamed tributary (Mahurangi River catchment)	WW2-S4^	Intermittent	Poor	Low	NOR 2
Unnamed tributary (Mahurangi River catchment)	WW3-S1a^	Permanent	Moderate	Moderate	NOR 3
Unnamed tributary (Mahurangi River catchment)	WW3-S1b^	Permanent	Moderate	Moderate	NOR 3
Unnamed tributary (Mahurangi River catchment)	WW3-S1c^	Permanent	Moderate	Moderate	NOR 3

Stream Name	Stream ID	Hydroperiod	RHA Category	Ecological Value	Relevant NOR
Unnamed tributary (Mahurangi River catchment)	WW3-S2a^	Permanent	Poor	Moderate	NOR 3
Unnamed tributary (Mahurangi River catchment)	WW3-S2b^	Permanent	Poor	Moderate	NOR 3
Unnamed tributary (Mahurangi River catchment)	WW3-S3a^	Permanent	Poor	Moderate	NOR 3, NOR 8
Unnamed tributary (Mahurangi River catchment)	WW3-S3b^	Permanent	Poor	Moderate	NOR 3, NOR 8
Unnamed tributary (Mahurangi River catchment)	WW3-S4a^	Permanent	Moderate	Moderate	NOR 3
Unnamed tributary (Mahurangi River catchment)	WW3-S4b^	Permanent	Poor	Moderate	NOR 3
Unnamed tributary (Mahurangi River catchment)	WW4-S1^	Intermittent	Poor	Low	NOR 4
Unnamed tributary (Mahurangi River catchment)	WW4-S2^	Intermittent	Poor	Low	NOR 4

Stream Name	Stream ID	Hydroperiod	RHA Category	Ecological Value	Relevant NOR
Unnamed tributary (Mahurangi River catchment)	WW4-S3^	Intermittent	Poor	Low	NOR 4
Mahurangi River tributary	WW5-S1	Permanent	Excellent	High	NOR 5
Mahurangi River tributary	WW5-S2^	Permanent	Moderate	Moderate	NOR 5, NOR 7
Unnamed tributary (Mahurangi River catchment)	WW5-S3^	Intermittent	Poor	Low	NOR 5, NOR 7
Unnamed tributary (Mahurangi River catchment)	WW5-S4	Intermittent	Poor	Low	NOR 5
Unnamed tributary (Mahurangi River catchment)	WW5-S5	Intermittent	Poor	Low	NOR 5
Unnamed tributary (Mahurangi River catchment)	WW5-S6	Intermittent	Moderate	Low	NOR 5
Unnamed tributary (Mahurangi River catchment)	WW6-S1	Intermittent	Poor	Moderate	NOR 6
Unnamed tributary (Mahurangi River catchment)	WW6-S2	Intermittent	Moderate	Moderate	NOR 6

Stream Name	Stream ID	Hydroperiod	RHA Category	Ecological Value	Relevant NOR
Unnamed tributary (Mahurangi River catchment)	WW7-S1^	Intermittent	Poor	Low	NOR 7
Unnamed tributary (Mahurangi River catchment)	WW7-S2a	Permanent	Moderate	Moderate	NOR 7
Unnamed tributary (Mahurangi River catchment)	WW7-S2b	Intermittent	Poor	Low	NOR 7
Unnamed tributary (Mahurangi River catchment)	WW7-S3a	Permanent	Moderate	Moderate	NOR 7
Unnamed tributary (Mahurangi River catchment)	WW7-S3b	Intermittent	Poor	Low	NOR 7
Unnamed tributary (Mahurangi River catchment)	WW7-S4	Permanent	Good	High	NOR 7
Unnamed tributary (Mahurangi River catchment)	WW7-S5	Intermittent	Poor	Low	NOR 7
Unnamed tributary (Mahurangi River catchment)	WW7-S6a	Intermittent	Poor	Low	NOR 7

Stream Name	Stream ID	Hydroperiod	RHA Category	Ecological Value	Relevant NOR
Unnamed tributary (Mahurangi River catchment)	WW7-S6b	Intermittent	Poor	Low	NOR 7
Mahurangi River (Right Branch) tributary	WW8-S1	Intermittent	Moderate	Moderate	NOR 8
Mahurangi River (Right Branch) tributary	WW8-S2	Intermittent	Moderate	Moderate	NOR 8
Mahurangi River (Right Branch)	WW8-S3*	Permanent	N/A	High	NOR 8

Notes: ^ = Ecological feature assessed from roadside or adjacent property boundary due to access restrictions. * = Ecological feature assessed at a desktop level due to access restrictions.

5.3.2 Fish

The NZFFD (Stoffels, 2022) was reviewed for native freshwater fish and freshwater invertebrate records within stream catchments associated with the Project Area. Of the freshwater fish recorded, three species are classified as 'At Risk'; īnanga (*Galaxias maculatus*), longfin eel (*Anguilla australis*), and giant bully (*Gobiomorphus gobioides*) (Dunn et al., 2017). Of the freshwater invertebrate records, one species is classified 'At Risk', freshwater mussel (*Echyridella menziesi*) (Grainger et al., 2018). The desktop review results are presented in Table 5-9 and Table 5-10.

Fish surveys were not carried out during site investigations; however, longfin eel (At Risk – Declining) and gambusia (*Gambusia affinis*) (Introduced and Naturalised) were observed onsite at WW2-S2.

Table 5-9 Native freshwater fish species recorded within the catchments associated with the Project Area

Common Name	Scientific Name	Conservation Status (Dunn et al., 2017)	Catchment and Relevant NOR		
			NORs 1, 4, 5, 7	NOR 2	NORs 2, 3, 8
			Mahurangi River	Mahurangi River (Left Branch)	Mahurangi River (Right Branch)
Banded kōkopu	*Galaxias fasciatus*	Not Threatened	✓	✓	
Common bully	*Gobiomorphus cotidianus*	Not Threatened	✓	✓	✓
Crans bully	*Gobiomorphus basalis*	Not Threatened	✓	✓	✓
Giant bully	*Gobiomorphus gobioides*	At Risk – Naturally Uncommon	✓		
Īnanga	*Galaxias maculatus*	At Risk - Declining	✓	✓	
Longfin eel	*Anguilla dieffenbachii*	At Risk - Declining	✓	✓	✓
Redfin bully	*Gobiomorphus huttoni*	Not Threatened	✓	✓	✓
Shortfin eel	*Anguilla australis*	Not Threatened	✓	✓	✓
Unidentified eel	*Anguilla* sp.	N/A	✓	✓	✓
Unidentified bully	*Gobiomorphus* sp.	N/A	✓		✓
Unidentified galaxiid	*Galaxias* sp.	N/A	✓		

Table 5-10 Native freshwater invertebrate species recorded within the catchments associated with the Project Area

Common Name	Scientific Name	Conservation Status (Grainger et al., 2018)	Catchment and Relevant NOR		
			NORs 4, 5, 7, 1	NOR 2	NORs 2, 3, 8
			Mahurangi River	Mahurangi River (Left Branch)	Mahurangi River (Right Branch)
Freshwater mussel	*Echyridella menziesi*	At Risk - Declining		✓	✓
Freshwater shrimp	*Paratya curvirostis*	Not Threatened	✓	✓	✓
Koura	*Paranephrops planifrons*	Not Threatened	✓	✓	✓

5.4 Wetland Habitat

A total of 30 wetlands within the Project Area designation boundary were identified and assessed. Table 5-11 summarises the wetland types and their classification (Singers et al., 2017) associated with the Project Area. Mapping of wetlands is presented in Appendix 5.

Table 5-11 Description of the wetland types present within the Project Area

Habitat	Classification	Description of Habitat
Exotic Wetland	EW	Wetland ecosystems with >50% exotic plant biomass.
Open Water	OW	Open Water (e.g., ornamental ponds, stormwater ponds, stock ponds).
Planted Wetland - Native (recent)	PLW	Native restoration plantings with <50% exotic biomass.
Raupō reedland	WL19	Dominated by abundant raupō, locally with species of pūrua grass, lake clubrush, jointed twig rush, toetoe, pūkio and harakeke. In northern New Zealand, swamp millet can be abundant.

Details regarding the vegetation cover, NPS-FM classification, potential for supporting TAR bird species (further described in Section 5.2.3)[16], and ecological value for each wetland is presented in Table 5-12 and Appendix 8 presents the detailed ecological value for wetlands identified in the Project Area.

[16] Additionally, there is potential for long-tailed bats and native herpetofauna to utilise wetland habitat in the Project Area.

Table 5-12 Summary of wetlands identified in the Project Area and their ecological value

Wetland ID	Vegetation/Wetland Type[17]	NPS-FM Classification	Potential for TAR Species	Ecological Value	Relevant NOR
WW1-W1*	Exotic Wetland (EW)	Natural inland wetland	Foraging habitat for Australasian bittern. Nesting and foraging habitat for spotless crake.	Moderate	NOR 1
WW1-W2*	Exotic Wetland (EW)	Natural inland wetland	Unlikely to support TAR birds.	Low	NOR 1
WW2-W1^	Exotic Wetland (EW)	Natural inland wetland	Unlikely to support TAR birds.	Low	NOR 2, NOR 8
WW2-W2^	Exotic Wetland (EW)	Natural inland wetland	Unlikely to support TAR birds.	Low	NOR 2
WW3-W1^	Exotic Wetland (EW)	Natural inland wetland	Foraging habitat for Australasian bittern. Nesting and foraging habitat for spotless crake.	Moderate	NOR 3, NOR 6
WW3-W2	Exotic Wetland (EW)	Natural inland wetland	Unlikely to support TAR birds.	Low	NOR 3
WW3-W3^	Exotic Wetland (EW)	Natural inland wetland	Foraging habitat for Australasian bittern. Nesting and foraging habitat for spotless crake.	Moderate	NOR 3

[17] Open water, as an ecological feature, has been included under the wetland section.

Wetland ID	Vegetation/Wetland Type[17]	NPS-FM Classification	Potential for TAR Species	Ecological Value	Relevant NOR
WW3-W4^	Exotic Wetland (EW)	Natural inland wetland	Foraging habitat for Australasian bittern. Nesting and foraging habitat for spotless crake.	Moderate	NOR 3
WW3-W5^	Exotic Wetland (EW)	Natural inland wetland	Foraging habitat for Australasian bittern. Nesting and foraging habitat for spotless crake.	Low	NOR 3
WW4-W1^	Exotic Wetland (EW)	Natural inland wetland	Foraging habitat for Australasian bittern and spotless crake.	Moderate	NOR 4
WW4-W2^	Exotic Wetland (EW)	Natural inland wetland	Foraging habitat for Australasian bittern and spotless crake.	Moderate	NOR 4
WW4-W3^	Exotic Wetland (EW)	Natural inland wetland	Foraging habitat for Australasian bittern and spotless crake.	Low	NOR 4
WW5-W1^	Exotic Wetland (EW)	Natural inland wetland	Unlikely to support TAR birds.	Low	NOR 5
WW5-W2^	Exotic Wetland (EW)	Natural inland wetland	Foraging habitat for Australasian bittern. Nesting and foraging habitat for spotless crake.	Low	NOR 5
WW5-W3^	Exotic Wetland (EW)	Natural inland wetland	Foraging habitat for Australasian bittern.	Low	NOR 5

Wetland ID	Vegetation/Wetland Type[17]	NPS-FM Classification	Potential for TAR Species	Ecological Value	Relevant NOR
			Nesting and foraging habitat for spotless crake.		
WW6-O1*	Open Water (OW)	Artificial wetland	Unlikely to support TAR birds.	Low	NOR 6
WW6-O1*	Open Water (OW)	Artificial wetland	Unlikely to support TAR birds.	Low	NOR 6
WW6-W1	Raupō reedland (WL19)	Natural inland wetland	Foraging habitat for Australasian bittern. Nesting and foraging habitat for spotless crake.	Moderate	NOR 6
WW7-W1^	Exotic Wetland (EW)	Natural inland wetland	Unlikely to support TAR birds.	Low	NOR 7
WW7-W2	Exotic Wetland (EW)	Natural inland wetland	Unlikely to support TAR birds.	Low	NOR 7
WW7-W3	Exotic Wetland (EW)	Natural inland wetland	Foraging habitat for Australasian bittern. Nesting and foraging habitat for spotless crake.	Moderate	NOR 7
WW7-W4	Exotic Wetland (EW)	Natural inland wetland	Unlikely to support TAR birds.	Low	NOR 7
WW7-W5	Exotic Wetland (EW)	Natural inland wetland	Unlikely to support TAR birds.	Low	NOR 7

Wetland ID	Vegetation/Wetland Type[17]	NPS-FM Classification	Potential for TAR Species	Ecological Value	Relevant NOR
WW7-W6	Exotic Wetland (EW)	Natural inland wetland	Unlikely to support TAR birds.	Low	NOR 7
WW7-W7^	Exotic Wetland (EW)	Natural inland wetland	Unlikely to support TAR birds.	Low	NOR 7
WW7-W8^	Exotic Wetland (EW)	Natural inland wetland	Unlikely to support TAR birds.	Low	NOR 7
WW8-W1	Planted Wetland (PLW)	Natural inland wetland	Nesting and foraging habitat for dabchick. Foraging habitat for Australasian bittern. Nesting and foraging habitat for spotless crake.	Moderate	NOR 8
WW8-W2	Exotic Wetland (EW)	Natural inland wetland	Unlikely to support TAR birds.	Low	NOR 8
WW8-W3^	Exotic Wetland (EW)	Natural inland wetland	Unlikely to support TAR birds.	Low	NOR 8
WW8-W4^	Exotic Wetland (EW)	Natural inland wetland	Foraging habitat for Australasian bittern. Nesting and foraging habitat for spotless crake.	Moderate	NOR 8

Notes: ^ = Ecological feature assessed from roadside or adjacent property boundary due to access restrictions. * = Ecological feature assessed at a desktop level due to access restrictions.

6 Warkworth Positive Effects

The following section outlines the positive effects of the proposed alignment for each NOR in relation to specific ecological features (Table 6-1). Refer to Appendix 5 for a map showing the location of the ecological features mentioned in Table 6-1. The statement regarding positive effects assumes standard native planting (in accordance with AT guidelines)[18] will occur on the roadsides as part of the landscape management and that margins and banks of stormwater wetlands will be planted with native vegetation.

There is the potential for positive effects which apply to each of the NORs. These include:

- Improved blue/green infrastructure (stormwater wetlands, swales, raingardens) and associated landscaping (which will be indigenous species).
- Revegetation of sloping berms, batters, and embankments to connect with retained forest remnant/mature trees.
- The proposed bat mitigation in association with the revegetation and stormwater wetlands mentioned above will have positive ecological outcomes for all native fauna. The proposed bat mitigation associated with Mahurangi River (and associated tributaries) are likely to improve ecological connectivity through the FUZ for other native fauna.

Table 6-1 Summary of positive effects associated with each NOR

Relevant NOR	Ecological Feature	Positive Effect
NOR 2	Mahurangi River (WW2-S3), Mahurangi Tributary (WW2-S2)	The Project landscape planting will tie into stream and riparian corridors. Riparian vegetation will be retained (where practicable) and enhanced (weeds control and indigenous vegetation planted).
NOR 3	Mahurangi Tributary (WW3-S1, WW3, S2, WW3-S4)	
NOR 5	Mahurangi Tributary (WW5-S1, WW5-2S),	
NOR 6	Mahurangi Tributary (WW6-S2) and raupo wetland (WL19)	
NOR 8	Mahurangi Tributary (WW8-S2)	
NOR 2	Mahurangi River (WW2-S3), Mahurangi Tributary (WW2-S2)	Existing infrastructure upgrades will include new bridge structures, culvert upgrades and additional/improvements to stormwater infrastructure. Upgrading undersized structures and improvements in culvert design such as embedding culverts with natural substrate/increased design capacity will improve habitat connectivity for freshwater and terrestrial species. This will include improved fish passage and improved riparian habitat connectivity.
NOR 3	Mahurangi Tributary (WW3-S1)	
NOR 5	Mahurangi Tributary (WW5-S1, WW5-2S),	
NOR 7	Mahurangi Tributary (WW5-S2), and stream WW7-S2	

[18] Landscape planting will be in line with the Urban and Landscape Design Management Plan (ULDMP).

7 NOR 1: Northern Public Transport Hub and and Western Link - North

This section assesses specific ecological matters relating to NOR 1 – Northern Public Transport and Western Link – North.

7.1 Overview and Description of Works

The Northern PT Hub and Park & Ride is located adjacent to the intersection of State Highway 1 and the proposed new Western Link - North.

The ecological features associated with the PT Hub and Park & Ride footprint is mainly characterised by a south-east facing hillslope bordered by two stream wetland complexes; one to east and one to the south of the footprint. The existing design provides a bridge crossing for both stream/wetland complexes. Terrestrial areas mainly consist of exotic pasture species and gorse. Wetland areas are indicated by exotic grass and sedges.

The Project involves:

- Construction of a PT Hub.
- Park and Ride facilities with approximately 228 car park spaces attached to the PT Hub.
- Construction of the new Western Link - North four-lane urban arterial with cycle lanes and footpaths.

Key features of the proposed Northern PT Hub and Park & Ride include the following:

- Construction of a four-lane urban arterial with cycle lanes and footpaths.
- Likely posted speed of 50 kph, design speed (of which effects will be assessed on) is 60 kph.
- Tie-ins with existing roads, stormwater wetland and culverts.
- Batter slopes to enable widening of the corridor, and associated cut and fill activities (earthworks).
- Vegetation removal.
- Other construction related activities required outside the permanent corridor including the re-grade of driveways, construction traffic manoeuvring and construction laydown areas.

Refer to the AEE for a more detailed description of works to be authorised.

7.2 Assessment of Ecological Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

Section 7.2 assesses the ecological effects of activities which relate to district plan matters under the AUP:OP.

7.2.1 Construction Effects - Terrestrial Ecology

The following potential construction effects to terrestrial fauna within and adjacent to the NOR (i.e. disturbance effects) have been identified:

- Disturbance and displacement to roosts/nests and individual (existing) long-tailed bats, avifauna, and herpetofauna due to construction activities (noise, light, vibration, dust etc.). It is assumed that this effect will occur after vegetation clearance (subject to regional consent controls) has been implemented and is therefore likely to happen in habitats adjacent to the project footprint/designation or underneath structures such as bridges.

The following sections detail the potential magnitude of effect and subsequent level of effect on ecological features (further detail regarding how these were determined are provided in Appendix 1). The effects assessment has considered two scenarios – the current ecological baseline and the 'existing environment' (i.e., allowing for permitted activities).

Impact management and residual effects are also presented where the level of effect is assessed to be **Moderate** or higher.

7.2.1.1 Long-tailed bats

Long-tailed bats may utilise the freshwater habitat associated with NOR 1 (streams WW1-S1 and WW1-S2) for foraging (there is no suitable roosting habitat present in the NOR). During construction of the Project, night works may be required, and site compounds are likely to be lit overnight. Lighting at night has the potential to modify the behaviour of bats if foraging within this area.

Table 7-1 outlines the effect assessment for long-tailed bats due to construction activities related to noise, light, dust, vibration etc.

Table 7-1 Assessment of ecological effects for long-tailed bats and impact management during construction for NOR 1

Effect Description	Disturbance and displacement to roosts and individual bats (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Negligible** due to the relatively short duration of construction related effects. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required.	Same as Baseline. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.
Impact management and residual level of effect	N/A	N/A
Management of residual effect	N/A	N/A

7.2.1.2 Avifauna

Noise, vibration, and lighting disturbance caused by construction activities could potentially displace native birds from suitable nesting and foraging habitat associated with NOR 1. Table 7-2 details the specific habitat that birds may be utilising in NOR 1.

Table 7-2 Potential habitat for avifauna in NOR 1

Species	Potential Habitat
Non-TAR birds	• All habitats, excluding Brown Field (BF)
New Zealand pipit	• Exotic Grass (EG) • Exotic Scrub (ES)
Australasian bittern	• Exotic Wetland (EW): WW1-W1
Spotless crake	• Exotic Wetland (EW): WW1-W1

Table 7-3 outlines the effect assessment for birds due to construction activities related to noise, light, dust, vibration etc.

Table 7-3 Assessment of ecological effects for avifauna and impact management during construction for NOR 1

Effect Description	Disturbance and displacement to nests and individual birds (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	**Non-TAR birds**[19] The magnitude of effect is assessed as **Low** due to the relatively short duration and likely probability of construction related effects. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required. **New Zealand pipit** The magnitude of effect was adjusted to **Moderate** to ensure a mitigation control for New Zealand pipit. This is because New Zealand pipit may require specific management during construction to prevent disturbance to nesting birds in the area. The ecological value of this species is **High**, and the overall level of effect is assessed as **High** prior to mitigation. **As such impact management is required**. **Australasian bittern** The magnitude of effect is assessed as **Negligible** due to the relatively short duration and unlikely probability of construction related effects. The ecological value of this species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required.	The magnitude of effect and overall level of effect is considered the same as Baseline for the following bird species: • Australasian bittern • Spotless crake **Non-TAR birds** The magnitude of effect is assessed as **Negligible** due to the relatively short duration and unlikely probability of construction related effects. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required. **New Zealand pipit** The magnitude of effect is assessed as **Negligible** due to the relatively short duration and unlikely probability of construction related effects. The ecological value of these species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.

[19] Effect is a function of value and magnitude, and effects that are Moderate or higher require mitigation. As the ecological value of Non-TAR birds is lower than TAR species, the magnitude of effect can increase without resulting in a Moderate or higher effect. Disturbance effects (at the level of the population) for Non-TAR birds are considered unlikely for Baseline and Likely Future Ecological Environment, therefore no additional mitigation is required in terms of the RMA. However, any harm or disturbance to individuals will need to be managed in accordance with the Wildlife Act 1953 (refer Section 16.1.2). This is applicable to all NORs.

Effect Description	Disturbance and displacement to nests and individual birds (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
	Spotless crake The magnitude of effect was adjusted to **Low** to ensure a mitigation control for spotless crake. This is because spotless crake may require specific management during construction to prevent disturbance to nesting birds in the area. The ecological value of this species is **High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. **As such impact management is required**.	
Impact management and residual level of effect	**New Zealand pipit** An Avifauna Management Plan for New Zealand pipit should be developed to include consideration for: • Pre-construction nesting bird surveys in suitable habitat (EG, ES). • Timing consideration for construction works (avoiding breeding season, where practicable). • Methods to minimise disturbance if the breeding season cannot be avoided. The residual impact is assessed as **Low** post mitigation. **Spotless crake** An Avifauna Management Plan for spotless crake should be developed to include consideration for: • Pre-construction nesting bird surveys at WW1-W1. • Timing consideration for construction works (avoiding breeding season, where practicable). • Methods to protect and buffer nesting birds (if present). The residual impact is assessed as **Very Low** post mitigation.	**Spotless crake** An Avifauna Management Plan for spotless crake should be developed to include consideration for: • Pre-construction nesting bird surveys at wetland WW1-W1. • Timing consideration for construction works (avoiding breeding season, where practicable). • Methods to protect and buffer nesting birds (if present). The residual impact is assessed as **Very Low** post mitigation.

Effect Description	Disturbance and displacement to nests and individual birds (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
Management of residual effect	N/A	N/A

7.2.1.3 Herpetofauna

Noise, vibration, dust, and lighting disturbance caused by construction activities could potentially displace native herpetofauna from suitable habitat associated with NOR 1. Table 7-4 details the specific habitat that herpetofauna may be utilising in NOR 1.

Table 7-4 Potential habitat for herpetofauna in NOR 1

Species	Potential Habitat
Copper skink	• All habitats where there is suitable understorey, excluding Brown Field (BF)

Table 7-5 outlines the effect assessment for herpetofauna due to construction activities related to noise, light, dust, vibration etc.

Table 7-5 Assessment of ecological effects for herpetofauna and impact management during construction for NOR 1

Effect Description	Disturbance and displacement of individuals (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	Likely Future Ecological Environment
Level of effect prior to impact management	**Copper skink** The magnitude of effect is assessed as **Low** due to the local extent and likely probability of construction related effects. The ecological value of this species is assessed as **High**, and the overall level of effect due to construction disturbance is assessed as **Low** prior to mitigation. As such no impact management is required.	**Copper skink** The magnitude of effect is assessed as **Negligible** due to the local extent and unlikely probability of construction related effects. The ecological value of this species is assessed as **High**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.
Impact management and residual level of effect	N/A	N/A
Management of residual effect	N/A	N/A

7.2.2 Operational Effects - Terrestrial Ecology

The following potential operational effects to terrestrial vegetation and terrestrial fauna within and adjacent to the NOR (as they relate to district matters) have been identified:

- Disturbance and displacement of indigenous fauna and their nests/roosts (e.g., long-tailed bats, avifauna, herpetofauna) due to light, noise, and vibration effects from the operation of the road; and
- Loss in connectivity to indigenous fauna (e.g., long-tailed bats, avifauna, herpetofauna) due to light, noise, and vibration effects from the operation of the road, leading to fragmentation of habitat.

The following sections detail the magnitude of effect and subsequent level of effect on ecological features (further detail regarding how these were determined are provided in Appendix 1). The effects assessment has considered two scenarios – the current ecological baseline and the 'existing environment' (i.e., allowing for permitted activities).

Impact management and residual effects are also presented where the level of effect is assessed to be **Moderate** or higher.

7.2.2.1 Long-tailed bats

The loss of connectivity through the presence of the road and associated disturbance such as operational noise, vibration, and light can lead to an overall reduction in size and quality of bat foraging habitat and can impact on bat movement in the broader landscape. Lighting spillage from street lighting could also disturb commuting and foraging bats at night and adversely affect insect prey populations.

Table 7-6 outlines the operational effects assessment and impact management for bats.

Table 7-6 Assessment of ecological effects for long-tailed bats and impact management during operation for NOR 1

	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
Effect Description	**Baseline**	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Negligible** due to the local extent of disturbance and unlikely probability of disturbance occurring. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Low** for the disturbance of individual bats and roosts. As such no impact management is required.	Same as Baseline. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.	The magnitude of effect is assessed as **Negligible** due to the unlikely probability of loss in connectivity occurring. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Low** for loss in connectivity. As such no impact management is required.	Same as Baseline.
Impact management and residual level of effect	N/A	N/A	N/A	N/A
Management of residual effect	N/A	N/A	N/A	N/A

7.2.2.2 Avifauna

Noise, vibration, and lighting disturbance caused by the presence of the road could potentially disturb and displace native birds from suitable nesting and foraging habitat within and adjacent to NOR 1 (refer to Section 7.2.1.2). Additionally, permanent habitat loss and operational noise, vibration, and light may also affect connectivity in the broader landscape.

Table 7-7 outlines the operational effects assessment and impact management for birds.

Table 7-7 Assessment of ecological effects for avifauna and impact management during operation for NOR 1

	Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
Effect Description	**Baseline**	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	**Non-TAR birds**[20] The magnitude of effect is assessed as **Low**, due to the local extent of effect and likely probability of disturbance due to noise, light and vibration from the areas of new road. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **New Zealand pipit** The magnitude of effect is assessed as **Negligible,** due to the local extent of effect and unlikely probability of disturbance due to	The magnitude of effect and overall level of effect is considered the same as Baseline for the following bird species: • Non-TAR birds • New Zealand pipit • Australasian bittern • Spotless crake Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.	**Non-TAR birds** The magnitude of effect is assessed as **Low** due to the local extent of effect and likely probability of loss in connectivity from the areas of new road. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **New Zealand pipit** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road.	The magnitude of effect and overall level of effect is considered the same as Baseline for the following bird species: • New Zealand pipit • Australasian bittern • Spotless crake **Non-TAR birds** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required.

[20] Effect is a function of value and magnitude, and effects that are Moderate or higher require mitigation. As the ecological value of Non-TAR birds is lower than TAR species, the magnitude of effect can increase without resulting in a Moderate or higher effect. Disturbance and connectivity effects (at the level of the population) for Non-TAR birds are considered unlikely for Baseline and Likely Future Ecological Environment, therefore no additional mitigation is required in terms of the RMA. However, any harm or disturbance to individuals will need to be managed in accordance with the Wildlife Act 1953 (refer Section 16.1.2). This is applicable to all NORs.

Effect Description	Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	noise, light and vibration from the areas of new road. The ecological value of these species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Australasian bittern** The magnitude of effect is assessed as **Negligible,** due to the local extent of effect and unlikely probability of disturbance due to noise, light and vibration from the areas of new road. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Spotless crake** The magnitude of effect was adjusted to **Low** to ensure a		The ecological value of these species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Australasian bittern** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Spotless crake** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road.	Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.

Effect Description	Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	mitigation control for spotless crake. This is because spotless crake may require specific management during operation to prevent disturbance to nesting birds in the area. The ecological value of these species is **High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. **As such impact management is required**.		The ecological value of this species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required.	
Impact management and residual level of effect	**<u>Spotless crake</u>** An Avifauna Management Plan for spotless crake should be developed to include consideration for: • Retention of vegetation near wetland habitat, where practicable. • Buffer planting between the road alignment and suitable habitat adjacent to the road (specifically wetland WW1-W1). The residual impact is assessed as **Very Low** post mitigation.		N/A	N/A

Effect Description	Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
Management of residual effect	N/A	N/A	N/A	N/A

7.2.2.3 Herpetofauna

Suitable habitat was identified within the NOR boundary which could potentially support herpetofauna. Native herpetofauna require vegetated corridors to facilitate natural dispersal, although they are considered to be relatively resident species and do not require migration or large-scale movement to support reproduction, refuge and feeding.

As the majority of NOR 1 will be new infrastructure, it is likely that there will only be some localised lizard disturbance from noise, vibration and lighting and fragmentation of lizard habitat for a short period during operation.

Table 7-8 outlines the operational effects assessment and impact management for herpetofauna.

Table 7-8 Assessment of ecological effects for herpetofauna and impact management during operation for NOR 1

Effect Description	Disturbance and displacement of existing and future herpetofauna due to light, noise and vibration effects from the presence of the road		Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	**Copper skink** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and relatively local extent of disturbance if the effect occurs. The ecological value of this species is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Very Low** prior to mitigation. As such no impact management is required.	**Copper skink** Same as Baseline. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.	**Copper skink** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and relatively local extent of loss in connectivity if the effect occurs. The ecological value of this species is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Very Low** prior to mitigation. As such no impact management is required.	**Copper skink** Same as Baseline. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.
Impact management and residual level of effect	N/A	N/A	N/A	N/A
Management of residual effect	N/A	N/A	N/A	N/A

7.2.3 Effects Conclusions

The ecological level of effects assessed as **Moderate** or higher for NOR 1 are described in Sections 7.2.3.1 and 7.2.3.2.

7.2.3.1 Construction Effects

New Zealand pipit

- **High** level of effect for disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics during construction for the Baseline only.

The post mitigation level of effect is considered to be **Low** for construction related effects.

Spotless crake

- **Moderate** level of effect for disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics during construction for the Baseline and Likely Future Ecological Environment.

The post mitigation level of effect is considered to be **Low** for construction related effects.

7.2.3.2 Operational Effects

Spotless crake

- **Moderate** level of effect for disturbance and displacement to nests and individuals of (new and existing) due to the presence of the infrastructure (noise, light, vibration etc) resulting in changes to the population dynamics during operation for the Baseline and Likely Future Ecological Environment.

The post mitigation level of effect is considered to be **Very Low** for operational related effects.

8 NOR 2: Woodcocks Road Upgrade (Western Section)

This section assesses specific ecological matters relating to NOR 2 - Woodcocks Road Upgrade (Western Section).

8.1 Overview and Description of Works

The Project proposes the upgrade of Woodcocks Road to a two lane urban arterial cross-section with cycle lanes and footpaths on the corridor.

The NOR 2 corridor features an east-west alignment, crossing the right branch of the Mahurangi River and running parallel to the left branch for approximately 800 m. The riparian features associated with the Mahurangi River north of Woodcocks Road constitutes a terrestrial SEA (SEA_T_6676). The SEA is relatively consistent with a Kauri, podocarp broadleaved forest type. However, the portion of the SEA north of the Mahurangi River (left branch) crossing is more consistent with a native and exotic treeland mix. To the south of the crossing the riparian features are generally consistent with kānuka scrub forest. Other ecological features include a permanent stream crossing on the western side of the NOR (a tributary of the Mahurangi River (right branch)), an intermittent stream/wetland crossing north-east of the Mason and Woodcock junction and a small depression wetland on the corner of Wylie and Woodcocks Roads.

Key features of the proposed new corridor include the following:

- Upgrading the corridor to a two-lane urban arterial with walking and cycling facilities on the corridor.
- Likely posted speed of 50 kph, design speed (of which effects will be assessed on) is 60 kph.
- Tie-ins with existing roads, stormwater wetland and culverts.
- Batter slopes to enable widening of the corridor, and associated cut and fill activities (earthworks).
- Vegetation removal along the existing road corridor.
- Upgraded crossing over the Mahurangi River.
- Other construction related activities required outside the permanent corridor including the re-grade of driveways, construction traffic manoeuvring and construction laydown areas.

Refer to the AEE for a detailed description of works to be authorised.

8.2 Assessment of Ecological Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

Section 8.2 assesses the ecological effects of activities which relate to district plan matters under the AUP:OP.

8.2.1 Construction Effects - Terrestrial Ecology

The following potential construction effects to terrestrial fauna within and adjacent to the NOR (i.e. disturbance effects) have been identified:

- Disturbance and displacement to roosts/nests and individual (existing) long-tailed bats, avifauna, and herpetofauna due to construction activities (noise, light, vibration, dust etc.). It is assumed that this effect will occur after vegetation clearance (subject to regional consent controls) has been implemented and is therefore likely to happen in habitats adjacent to the project footprint/designation or underneath structures such as bridges.

The following sections detail the potential magnitude of effect and subsequent level of effect on ecological features (further detail regarding how these were determined are provided in Appendix 1). The effects assessment has considered two scenarios – the current ecological baseline and the 'existing environment' (i.e., allowing for permitted activities).

Impact management and residual effects are also presented where the level of effect is assessed to be **Moderate** or higher.

8.2.1.1 Long-tailed bats

Bats may utilise the terrestrial and freshwater habitats associated with NOR 2 for roosting or foraging. Specifically, streams WW2-S1, WW2-S2, and WW2-S3, and areas of Mixed Native/Exotic Treeland (TL.2), Exotic-Dominated Treeland (TL.3), and Kauri, Podocarp, Broadleaved Forest (WF11). During construction of the Project, night works may be required, and site compounds are likely to be lit overnight. Lighting at night has the potential to modify the behaviour of bats if foraging within this area or roosting in nearby isolated stands of mature trees. Noise and vibration during construction can be an issue if bats are roosting in the immediate vicinity of the construction works.

Table 7-1 outlines the effect assessment for long-tailed bats due to construction activities related to noise, light, dust, vibration etc.

Table 8-1 Assessment of ecological effects for long-tailed bats and impact management during construction for NOR 2

Effect Description	Disturbance and displacement to roosts and individual bats (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Low** due to the relatively short duration of construction related effects and likely probability of the effect occurring. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. **As such impact management is required**.	Same as Baseline due to the retention of vegetation within riparian corridors. Additionally, some areas of the NOR may also provide bat habitat if construction occurs prior to urbanisation. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.
Impact management and residual level of effect	A Bat Management Plan (BMP) should be developed to include consideration for: • Surveys prior to construction to confirm presence/likely absence. Surveys to confirm bat roost locations if activity is confirmed. • Confirmation of maternity roosts may require a seasonal restriction on construction activity (no or restricted construction during Dec-Mar). • Siting of compounds and laydown areas to avoid TL.2, TL.3, and WF11 habitat. • Lighting design to reduce light levels and spill from construction areas. • Restriction of nightworks around TL.2, TL.3, and WF11 habitat. • Bat management should be incorporated with any regional consent conditions (i.e., BMPs) that may be required for regional compliance. The residual impact is assessed as **Very Low** post mitigation.	Same as Baseline.
Management of residual effect	N/A	N/A

8.2.1.2 Avifauna

Noise, vibration, and lighting disturbance caused by construction activities could potentially displace native birds from suitable nesting and foraging habitat associated with NOR 2. Table 8-2 details the specific habitat that birds may be utilising in NOR 2.

Table 8-2 Potential habitat for avifauna in NOR 2

Species	Potential Habitat
Non-TAR birds	• All habitats, excluding Brown Field (BF)
New Zealand pipit	• Exotic Grass (EG) • Exotic Scrub (ES)
North Island kākā	• Mixed Native/Exotic Treeland (TL.2) • Exotic-Dominated Treeland (TL.3) • Kauri, Podocarp, Broadleaved Forest (WF11)
Long-tailed cuckoo	• Mixed Native/Exotic Treeland (TL.2) • Exotic-Dominated Treeland (TL.3) • Kauri, Podocarp, Broadleaved Forest (WF11)
Black shag	• Permanent streams and their associated tributaries: - WW2-S1 - WW2-S2 - WW2-S3
Little black shag	• Permanent streams and their associated tributaries: - WW2-S1 - WW2-S2 - WW2-S3
Little shag	• Permanent streams and their associated tributaries: - WW2-S1 - WW2-S2 - WW2-S3
Pied shag	• Permanent streams and their associated tributaries: - WW2-S1 - WW2-S2 - WW2-S3

Table 7-3 outlines the effect assessment for birds due to construction activities related to noise, light, dust, vibration etc,

Table 8-3 Assessment of ecological effects for avifauna and impact management during construction for NOR 2

Effect Description	Disturbance and displacement to nests and individual birds (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	**Non-TAR birds** The magnitude of effect is assessed as **Negligible** due to the relatively short duration and unlikely probability of construction related effects. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required. **New Zealand pipit** The magnitude of effect was adjusted to **Moderate** to ensure a mitigation control for New Zealand pipit. This is because New Zealand pipit may require specific management during construction to prevent disturbance to nesting birds in the area. The ecological value of this species is **High**, and the overall level of effect is assessed as **High** prior to mitigation. **As such impact management is required**. **Long-tailed cuckoo** The magnitude of effect is assessed as **Negligible** due to the relatively short duration and unlikely probability of construction related effects. The ecological value of this species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **North Island kākā**	The magnitude of effect and overall level of effect is considered the same as Baseline for the following bird species: • Non-TAR birds • Long-tailed cuckoo • North Island kākā • Black shag • Little black shag • Pied shag • Little shag **New Zealand pipit** The magnitude of effect is assessed as **Negligible** due to the relatively short duration and unlikely probability of construction related effects. The ecological value of this species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.

Effect Description	Disturbance and displacement to nests and individual birds (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
	The magnitude of effect is assessed as **Negligible** due to the relatively short duration and unlikely probability of construction related effects. The ecological value of this species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Black shag, little black shag, pied shag, little shag** The magnitude of effect is assessed as **Negligible** due to the relatively short duration and unlikely probability of construction related effects. The ecological value of this species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required.	
Impact management and residual level of effect	**New Zealand pipit** An Avifauna Management Plan for New Zealand pipit should be developed to include consideration for: • Pre-construction nesting bird surveys in suitable habitat (EG, ES). • Timing consideration for construction works (avoiding breeding season, where practicable). • Methods to minimise disturbance if the breeding season cannot be avoided. The residual impact is assessed as **Low** post mitigation.	N/A
Management of residual effect	N/A	N/A

8.2.1.3 Herpetofauna

Noise, vibration, and lighting disturbance caused by construction activities could potentially displace native herpetofauna from suitable habitat associated with NOR 2. Table 8-4 details the specific habitat that herpetofauna may be utilising in NOR 2.

Table 8-4 Potential habitat for herpetofauna in NOR 2

Species	Potential Habitat
Copper skink	• All habitats where there is suitable understorey, excluding Brown Field (BF)
Ornate skink	• All habitats contiguous to native forest or scrub and where there is suitable understorey, excluding Brown Field (BF)
Elegant gecko	• Kauri, Podocarp, Broadleaved Forest (WF11)
Forest gecko	• Kauri, Podocarp, Broadleaved Forest (WF11)
Pacific gecko	• Kauri, Podocarp, Broadleaved Forest (WF11)

Table 7-3 outlines the effect assessment for herpetofauna due to construction activities related to noise, light, dust, vibration etc.

Table 8-5 Assessment of ecological effects for herpetofauna and impact management during construction for NOR 2

Effect Description	Disturbance and displacement of individuals (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	**Copper skink, ornate skink** The magnitude of effect is assessed as **Negligible** due to the local extent and unlikely probability of construction related effects. The ecological value of these species is assessed as **High**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Elegant gecko, forest gecko** The magnitude of effect is assessed as **Low** due to the local extent and likely probability of construction related effects. The ecological value of these species is assessed as **High**, and the overall level of effect due to construction disturbance is assessed as **Low** prior to mitigation. As such no impact management is required. **Pacific gecko** The magnitude of effect is assessed as **Low** due to the local extent and likely probability of construction related effects. The ecological value of this species is assessed as **Moderate**, and the overall level of effect due to construction disturbance is assessed as **Low** prior to mitigation. As such no impact management is required.	The magnitude of effect and overall level of effect is considered the same as Baseline for the following herpetofauna species: • Copper skink • Ornate skink **Elegant gecko, forest gecko** The magnitude of effect is assessed as **Negligible** due to the local extent and unlikely probability of construction related effects. The ecological value of these species is assessed as **High**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Pacific gecko** The magnitude of effect is assessed as **Negligible** due to the local extent and unlikely probability of construction related effects. The ecological value of this species is assessed as **Moderate**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.
Impact management and residual level of effect	N/A	N/A

Effect Description	Disturbance and displacement of individuals (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	Likely Future Ecological Environment
Management of residual effect	N/A	N/A

8.2.2 Operational Effects - Terrestrial Ecology

Refer to Section 7.2.2.

8.2.2.1 Long-tailed bats

The loss of connectivity through the presence of the road and associated disturbance such as operational noise, vibration, and light can lead to an overall reduction in size and quality of bat foraging habitat, it can impact on bat movement in the broader landscape and can potentially disturb nearby bat roosts (including maternity roosts). Lighting spillage from street lighting could also disturb commuting and foraging bats at night and adversely affect insect prey populations.

Table 8-6 outlines the operational effects assessment and impact management for bats.

Table 8-6 Assessment of ecological effects for long-tailed bats and impact management during operation for NOR 2

	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
Effect Description	**Baseline**	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Low** due to the relatively local extent of disturbance and likely probability of disturbance occurring. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Moderate** for the disturbance of individual bats and roosts. **As such impact management is required**.	Same as Baseline due to the retention of vegetation within riparian corridors. Additionally, some areas of the NOR may also provide bat habitat if construction occurs prior to urbanisation. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.	The magnitude of effect is assessed as **Moderate** due to the likely probability of loss in connectivity. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **High** for loss in connectivity. **As such impact management is required**.	Same as Baseline due to the retention of vegetation within riparian corridors. Additionally, some areas of the NOR may also provide bat habitat if construction occurs prior to urbanisation. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.
Impact management and residual level of effect	A Bat Management Plan (BMP) should be developed to include consideration for: • Early-stage/mature buffer planting, late-stage buffer planting, and retention of existing mature trees between	Same as Baseline.	A BMP should be developed with consideration to the indicative bat mitigation in Appendix 12 – [22]. The map indicates the location and extent of measures to mitigate potential connectivity effects and includes hop-overs/underpasses, buffer planting and existing mature tree features that will be retained, as well as indicating areas where	Same as Baseline.

[22] As verified by Dr Ian Davidson-Watts of Davidson-Watts Ecology (Pacific) Limited.

Effect Description	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	the road alignment and features with potential for bat roosts[21]. • Light and noise management through design. • Future presence of roosts within the alignment (placement of flaps on features with high roost potential). The residual impact is assessed as **Very Low** post mitigation.		early planting[23] (or planting of mature trees) will occur. The BMP should also have additional consideration for: • Lighting design to minimise light levels and light spill along the road corridor. • As an alternative to early restoration planting, restoration planting can make use of mature trees to achieve the same goal as early restoration planting. • Assumptions in the efficacy of the proposed mitigation will be addressed through an adaptive management framework that will outline bat activity thresholds, robust monitoring, and potential corrective action. The residual impact is assessed as **Low** post mitigation.	

[21] This may be in addition to the buffer planting proposed in Appendix 12 and will depend on the presence and location of roosts at the time of construction. The requirement for planting mature trees (as buffer) to mitigate roost disturbance, will depend on the future context such as the location of known roosts, the presence of existing buffer and the feasibility of including other design consideration that can control disturbance effects.

Effect Description	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
Management of residual effect	N/A	N/A	N/A	N/A

8.2.2.2 Avifauna

Noise, vibration, and lighting disturbance caused by the presence of the road could potentially disturb and displace native birds from suitable nesting and foraging habitat within and adjacent to NOR 2 (refer to Section 8.2.1.2). Additionally, permanent habitat loss and operational noise, vibration, and light may also affect connectivity in the broader landscape.

Table 8-7 outlines the operational effects assessment and impact management for birds.

Table 8-7 Assessment of ecological effects for avifauna and impact management during operation for NOR 2

	Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
Effect Description	**Baseline**	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	**Non-TAR birds** The magnitude of effect is assessed as **Low**, due to the local extent of effect and unlikely probability of disturbance due to noise, light and vibration from the areas of new road. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **New Zealand pipit** The magnitude of effect is assessed as **Negligible,** due to the local extent of effect and unlikely probability of disturbance due to noise, light and vibration from the areas of new road. The ecological value of these species is **High**, and the overall	The magnitude of effect and overall level of effect is considered the same as Baseline for the following bird species: • Non-TAR birds • New Zealand pipit • Long-tailed cuckoo • North Island kākā • Black shag • Little black shag • Pied shag • Little shag Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.	**Non-TAR birds** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **New Zealand pipit** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of these species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation.	The magnitude of effect and overall level of effect is considered the same as Baseline for the following bird species: • Non-TAR birds • New Zealand pipit • Long-tailed cuckoo • North Island kākā • Black shag • Little black shag • Pied shag • Little shag Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.

Effect Description	Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Long-tailed cuckoo** The magnitude of effect is assessed as **Negligible,** due to the local extent of effect and unlikely probability of disturbance due to noise, light and vibration from the areas of new road. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **North Island kākā** The magnitude of effect is assessed as **Negligible,** due to the local extent of effect and unlikely probability of disturbance due to noise, light and vibration from the areas of new road.		As such no impact management is required. **Long-tailed cuckoo** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **North Island kākā** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of this species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation.	

Effect Description	Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	The ecological value of these species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **<u>Black shag, little black shag, pied shag, little shag</u>** The magnitude of effect is assessed as **Negligible,** due to the local extent of effect and unlikely probability of disturbance due to noise, light and vibration from the areas of new road. The ecological value of these species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required.		As such no impact management is required. **<u>Black shag, little black shag, pied shag, little shag</u>** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of this species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required.	
Impact management and residual	N/A	N/A	N/A	N/A

Effect Description	Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
level of effect				
Management of residual effect	N/A	N/A	N/A	N/A

8.2.2.3 Herpetofauna

Suitable habitat was identified within the NOR boundary which could potentially support herpetofauna. Native herpetofauna require vegetated corridors to facilitate natural dispersal, although they are considered to be relatively resident species and do not require migration or large-scale movement to support reproduction, refuge and feeding.

As the majority of NOR 2 is an upgrade of an existing road, it is not expected to result in the additional fragmentation of herpetofauna habitat. Similarly, resident (existing and future) herpetofauna are likely to be habituated to disturbance such as noise, vibration, and lighting and no additional effect on herpetofauna is expected.

Table 8-8 outlines the operational effects assessment and impact management for herpetofauna.

Table 8-8 Assessment of ecological effects for herpetofauna and impact management during operation for NOR 2

Effect Description	Disturbance and displacement of existing and future herpetofauna due to light, noise and vibration effects from the presence of the road		Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	**Copper skink, ornate skink** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and relatively local extent of disturbance if the effect occurs. The ecological value of these species is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Elegant gecko, forest gecko** The magnitude of effect is assessed as **Low** due to the likely probability and relatively local extent of disturbance if the effect occurs. The ecological value of these species is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Low** prior to mitigation.	The magnitude of effect and overall level of effect is considered the same as Baseline for the following herpetofauna species: • Copper skink • Ornate skink **Elegant gecko, forest gecko** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and relatively local extent of disturbance if the effect occurs. The ecological value of these species is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Pacific gecko** The magnitude of effect is assessed as **Negligible** due to the unlikely	**Copper skink, ornate skink** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and relatively local extent of loss in connectivity if the effect occurs. The ecological value of these species is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Elegant gecko, forest gecko** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and relatively local extent of loss in connectivity if the effect occurs. The ecological value of these species is assessed to be **High**, and the overall level of effect due to the	The magnitude of effect and overall level of effect is considered the same as Baseline for the following herpetofauna species: • Copper skink • Ornate skink • Elegant gecko • Forest gecko • Pacific gecko Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.

Effect Description	Disturbance and displacement of existing and future herpetofauna due to light, noise and vibration effects from the presence of the road		Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	As such no impact management is required. **<u>Pacific gecko</u>** The magnitude of effect is assessed as **Low** due to the likely probability and relatively local extent of disturbance if the effect occurs. The ecological value of this species is assessed to be **Moderate**, and the overall level of effect due to the presence of the road is assessed as **Low** prior to mitigation. As such no impact management is required.	probability and relatively local extent of disturbance if the effect occurs. The ecological value of this species is assessed to be **Moderate**, and the overall level of effect due to the presence of the road is assessed as **Very Low** prior to mitigation. As such no impact management is required. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NoR.	presence of the road is assessed as **Very Low** prior to mitigation. As such no impact management is required. **<u>Pacific gecko</u>** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and relatively local extent of loss in connectivity if the effect occurs. The ecological value of this species is assessed to be **Moderate**, and the overall level of effect due to the presence of the road is assessed as **Very Low** prior to mitigation. As such no impact management is required.	
Impact management and residual level of effect	N/A	N/A	N/A	N/A

Effect Description	Disturbance and displacement of existing and future herpetofauna due to light, noise and vibration effects from the presence of the road		Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Management of residual effect	N/A	N/A	N/A	N/A

8.2.3 Effects Conclusions

The ecological level of effects assessed as **Moderate** or higher for NOR 2 are described in Sections 8.2.3.1 and 8.2.3.2.

8.2.3.1 Construction Effects

Long-tailed bats

- **Moderate** level of for disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics during construction for the Baseline and Likely Future Ecological Environment.

The post mitigation level of effect is considered to be **Low** for construction related effects.

New Zealand pipit

- **High** level of effect for disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics during construction for the Baseline only.

The post mitigation level of effect is considered to be **Low** for construction related effects.

8.2.3.2 Operational Effects

Long-tailed bats

- **High** level of effect for the loss in connectivity due to the presence of the road resulting in changes to the population dynamics during operation for the Baseline and Likely Future Ecological Environment.
- **Moderate** level of effect for disturbance and displacement to roosts and individuals of (new and existing) due to the presence of the infrastructure (noise, light, vibration etc) resulting in changes to the population dynamics during operation for the Baseline and Likely Future Ecological Environment.

The post mitigation level of effect is considered to be **Very Low** to **Low** for operational related effects.

9 NOR 3: State Highway 1 Upgrade - South

This This section assesses specific ecological matters relating to NOR 3 - State Highway 1 Upgrade - South.

9.1 Overview and Description of Works

The Project proposes the upgrade of State Highway 1 – South to a two lane urban arterial cross-section with cycle lanes and footpaths on the corridor.

Ecological features associated with NOR 3 mostly include exotic roadside planting, exotic shelterbelt, exotic pasture, several stream crossings (west draining tributaries of the Mahurangi River) and exotic wetlands (notably to the south-west of the State Highway and McKinney junction, as well as to the west of the State highway opposite the driving range).

Key features of the proposed corridor upgrade include the following:

- Upgrading the corridor to a two-lane urban arterial with walking and cycling facilities on the corridor.
- Likely posted speed of 50 kph, design speed (of which effects will be assessed on) is 60 kph.
- Tie-ins with existing roads, stormwater wetland and culverts.
- Batter slopes to enable widening of the corridor, and associated cut and fill activities (earthworks).
- Vegetation removal along the existing road corridor
- Other construction related activities required outside the permanent corridor including the re-grade of driveways, construction traffic manoeuvring and construction laydown areas.

Refer to the AEE for a more detailed description of works to be authorised.

9.2 Assessment of Ecological Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

Section 9.2 assesses the ecological effects of activities which relate to district plan matters under the AUP:OP.

9.2.1 Construction Effects - Terrestrial Ecology

Refer to Section 7.2.1.

9.2.1.1 Long-tailed bats

Long-tailed bats may utilise the freshwater habitat (all permanent streams) associated with NOR 3 for foraging, and suitable foraging and roosting terrestrial habitat is limited to isolated stands/single trees of Native-Dominated Treeland (TL.1), Mixed Native/Exotic Treeland (TL.2), Exotic-Dominated Treeland (TL.3), and Kānuka Scrub/Forest (VS2) that are adjacent to State Highway 1. During construction of the Project, night works may be required, and site compounds are likely to be lit overnight. Lighting at night has the potential to modify the behaviour of bats if foraging within this area or roosting in nearby isolated stands of mature trees. Noise and vibration during construction can be an issue if bats are roosting in the immediate vicinity of the construction works.

Table 9-1 outlines the effect assessment for long-tailed bats due to construction activities related to noise, light, dust, vibration etc.

Table 9-1 Assessment of ecological effects for long-tailed bats and impact management during construction for NOR 3

Effect Description	Disturbance and displacement to roosts and individual bats (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Negligible** due to the relatively short duration and unlikely probability of construction related effects. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required.	Same as Baseline due to the retention of vegetation within riparian corridors. Additionally, some areas of the NOR may also provide bat habitat if construction occurs prior to urbanisation. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.
Impact management and residual level of effect	N/A	N/A
Management of residual effect	N/A	N/A

9.2.1.2 Avifauna

Noise, vibration, and lighting disturbance caused by construction activities could potentially displace native birds from suitable nesting and foraging habitat associated with NOR 3. Table 9-2 details the specific habitat that birds may be utilising in NOR 3.

Table 9-2 Potential habitat for avifauna in NOR 3

Species	Potential Habitat
Non-TAR birds	• All habitats, excluding Brown Field (BF)
New Zealand pipit	• Exotic Grass (EG) • Exotic Scrub (ES)
Australasian bittern	• Exotic Wetland (EW): - WW3-W1 - WW3-W3 - WW3-W4 - WW3-W5
Spotless crake	• Exotic Wetland (EW): - WW3-W1 - WW3-W3 - WW3-W4 - WW3-W5

Table 9-3 Assessment of ecological effects for avifauna and impact management during construction for NOR outlines the effect assessment for birds due to construction activities related to noise, light, dust, vibration etc.

Table 9-3 Assessment of ecological effects for avifauna and impact management during construction for NOR 3

Effect Description	Disturbance and displacement to nests and individual birds (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	**Non-TAR birds** The magnitude of effect is assessed as **Negligible** due to the relatively short duration and unlikely probability of construction related effects. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required. **New Zealand pipit** The magnitude of effect was adjusted to **Moderate** to ensure a mitigation control for New Zealand pipit. This is because New Zealand pipit may require specific management during construction to prevent disturbance to nesting birds in the area. The ecological value of this species is **High**, and the overall level of effect is assessed as **High** prior to mitigation. **As such impact management is required**. **Australasian bittern** The magnitude of effect is assessed as **Negligible** due to the relatively short duration and unlikely probability of construction related effects. The ecological value of this species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Spotless crake** The magnitude of effect was adjusted to **Low** to ensure a mitigation control for spotless crake. This is because spotless crake may require specific	The magnitude of effect and overall level of effect is considered the same as Baseline for the following bird species: • Non-TAR birds • Australasian bittern • Spotless crake **New Zealand pipit** The magnitude of effect is assessed as **Negligible** due to the relatively short duration and unlikely probability of construction related effects. The ecological value of these species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.

Effect Description	Disturbance and displacement to nests and individual birds (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
	management during construction to prevent disturbance to nesting birds in the area. The ecological value of this species is **High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. **As such impact management is required**.	
Impact management and residual level of effect	**New Zealand pipit** An Avifauna Management Plan for New Zealand pipit should be developed to include consideration for: • Pre-construction nesting bird surveys in suitable habitat (EG, ES). • Timing consideration for construction works (avoiding breeding season, where practicable). • Methods to minimise disturbance if the breeding season cannot be avoided. The residual impact is assessed as **Low** post mitigation. **Spotless crake** An Avifauna Management Plan for spotless crake should be developed to include consideration for: • Pre-construction nesting bird surveys at wetlands WW3-W1, WW3-W3, WW3-W4, and WW3-W5. • Timing consideration for construction works (avoiding breeding season, where practicable). • Methods to protect and buffer nesting birds (if present). The residual impact is assessed as **Very Low** post mitigation.	**Spotless crake** An Avifauna Management Plan for spotless crake should be developed to include consideration for: • Pre-construction nesting bird surveys at wetlands WW3-W1, WW3-W3, WW3-W4, and WW3-W5. • Timing consideration for construction works (avoiding breeding season, where practicable). • Methods to protect and buffer nesting birds (if present). The residual impact is assessed as **Very Low** post mitigation.

Effect Description	Disturbance and displacement to nests and individual birds (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
Management of residual effect	N/A	N/A

9.2.1.3 Herpetofauna

Noise, vibration, and lighting disturbance caused by construction activities could potentially displace native herpetofauna from suitable habitat associated with NOR 3. Table 9-4 details the specific habitat that herpetofauna may be utilising in NOR 3.

Table 9-4 Potential habitat for herpetofauna in NOR 3

Species	Potential Habitat
Copper skink	• All habitats where there is suitable understorey, excluding Brown Field (BF)

Table 9-5 outlines the effect assessment for herpetofauna due to construction activities related to noise, light, dust, vibration etc.

Table 9-5 Assessment of ecological effects for herpetofauna and impact management during construction for NOR 3

Effect Description	Disturbance and displacement of individuals (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	Likely Future Ecological Environment
Level of effect prior to impact management	**Copper skink** The magnitude of effect is assessed as **Negligible** due to the local extent and unlikely probability of construction related effects. The ecological value of this species is assessed as **High**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required.	**Copper skink** Same as Baseline. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.
Impact management and residual level of effect	N/A	N/A
Management of residual effect	N/A	N/A

9.2.2 Operational Effects - Terrestrial Ecology

Refer to Section 7.2.2.

9.2.2.1 Long-tailed bats

The loss of connectivity through the presence of the road and associated disturbance such as operational noise, vibration, and light can lead to an overall reduction in size and quality of bat foraging habitat, it can impact on bat movement in the broader landscape and can potentially disturb

nearby bat roosts (including maternity roosts). Lighting spillage from street lighting could also disturb commuting and foraging bats at night and adversely affect insect prey populations.

Table 9-6 outlines the operational effects assessment and impact management for bats.

Table 9-6 Assessment of ecological effects for long-tailed bats and impact management during operation for NOR 3

Effect Description	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Negligible** due to the relatively local extent of disturbance and unlikely probability of disturbance occurring. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Very Low** for the disturbance of individual bats and roosts. As such no impact management is required.	Same as Baseline due to the retention of vegetation within riparian corridors. Additionally, some areas of the NOR may also provide bat habitat if construction occurs prior to urbanisation. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.	The magnitude of effect is assessed as **Low** due to the unlikely probability of loss in connectivity. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Moderate** for loss in connectivity. **As such impact management is required**.	Same as Baseline due to the retention of vegetation within riparian corridors. Additionally, some areas of the NOR may also provide bat habitat if construction occurs prior to urbanisation. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.
Impact management and residual level of effect	N/A	N/A	A BMP should be developed with consideration to the indicative bat mitigation in Appendix 12 – Indicative Mitigation Areas [24]. The map indicates the location and extent of measures to mitigate potential connectivity effects and includes hop-overs/underpasses, buffer planting and existing mature tree features that will be retained,	Same as Baseline.

[24] As verified by Dr Ian Davidson-Watts of Davidson-Watts Ecology (Pacific) Limited.

Effect Description	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
			as well as indicating areas where early planting[25] (or planting of mature trees) will occur. The BMP should also have additional consideration for: • Lighting design to minimise light levels and light spill along the road corridor. • As an alternative to early restoration planting, restoration planting can make use of mature trees to achieve the same goal as early restoration planting. • Assumptions in the efficacy of the proposed mitigation will be addressed through an adaptive management framework that will outline bat activity thresholds, robust monitoring, and potential corrective action. The residual impact is assessed as **Very Low** post mitigation.	

Effect Description	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
Management of residual effect	N/A	N/A	N/A	N/A

9.2.2.2 Avifauna

Noise, vibration, and lighting disturbance caused by the presence of the road could potentially disturb and displace native birds from suitable nesting and foraging habitat within and adjacent to NOR 3 (refer to Section 9.2.1.2). Additionally, permanent habitat loss and operational noise, vibration, and light may also affect connectivity in the broader landscape.

Table 9-7 outlines the operational effects assessment and impact management for birds.

Table 9-7 Assessment of ecological effects for avifauna and impact management during operation for NOR 3

	Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
Effect Description	**Baseline**	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	**Non-TAR birds** The magnitude of effect is assessed as **Low**, due to the local extent of effect and unlikely probability of disturbance due to noise, light and vibration from the areas of new road. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **New Zealand pipit** The magnitude of effect is assessed as **Negligible,** due to the local extent of effect and unlikely probability of disturbance due to noise, light and vibration from the areas of new road. The ecological value of these species is **High**, and the overall	The magnitude of effect and overall level of effect is considered the same as Baseline for the following bird species: • Non-TAR birds • New Zealand pipit • Australasian bittern • Spotless crake Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.	**Non-TAR birds** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **New Zealand pipit** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of these species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation.	The magnitude of effect and overall level of effect is considered the same as Baseline for the following bird species: • Non-TAR birds • New Zealand pipit • Australasian bittern • Spotless crake Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.

Effect Description	Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **<u>Australasian bittern</u>** The magnitude of effect is assessed as **Negligible,** due to the local extent of effect and unlikely probability of disturbance due to noise, light and vibration from the areas of new road. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **<u>Spotless crake</u>** The magnitude of effect was adjusted to **Low** to ensure a mitigation control for spotless crake. This is because spotless crake may require specific management during		As such no impact management is required. **<u>Australasian bittern</u>** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **<u>Spotless crake</u>** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of this species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation.	

Effect Description	Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	operation to prevent disturbance to nesting birds in the area. The ecological value of these species is **High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. **As such impact management is required**.		As such no impact management is required.	
Impact management and residual level of effect	**Spotless crake** An Avifauna Management Plan for spotless crake should be developed to include consideration for: • Retention of vegetation near wetland habitat, where practicable. • Buffer planting between the road alignment and suitable habitat adjacent to the road (specifically wetlands WW3-W1, WW3-W3, and WW3-W5). The residual impact is assessed as **Very Low** post mitigation.	Same as Baseline.	N/A	N/A

Effect Description	Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
Management of residual effect	N/A	N/A	N/A	N/A

9.2.2.3 Herpetofauna

Suitable habitat was identified within the NOR boundary which could potentially support herpetofauna. Native herpetofauna require vegetated corridors to facilitate natural dispersal, although they are considered to be relatively resident species and do not require migration or large-scale movement to support reproduction, refuge and feeding.

As the majority of NOR 3 is an upgrade of an existing road, it is not expected to result in the additional fragmentation of herpetofauna habitat. Similarly, resident (existing and future) herpetofauna are likely to be habituated to disturbance such as noise, vibration, and lighting and no additional effect on herpetofauna is expected.

Table 9-8 outlines the operational effects assessment and impact management for herpetofauna.

Table 9-8 Assessment of ecological effects for herpetofauna and impact management during operation for NOR 3

Effect Description	Disturbance and displacement of existing and future herpetofauna due to light, noise and vibration effects from the presence of the road		Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	**Copper skink** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and relatively local extent of disturbance if the effect occurs. The ecological value of this species is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Very Low** prior to mitigation. As such no impact management is required.	**Copper skink** Same as Baseline. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.	**Copper skink** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and relatively local extent of loss in connectivity if the effect occurs. The ecological value of this species is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Very Low** prior to mitigation. As such no impact management is required.	**Copper skink** Same as Baseline. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.
Impact management and residual level of effect	N/A	N/A	N/A	N/A
Management of residual effect	N/A	N/A	N/A	N/A

9.2.3 Effects Conclusions

The ecological level of effects assessed as **Moderate** or higher for NOR 3 are described in Sections 9.2.3.1 and 9.2.3.2.

9.2.3.1 Construction Effects

New Zealand pipit

- **High** level of effect for disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics during construction for the Baseline only.

The post mitigation level of effect is considered to be **Low** for construction related effects.

Spotless crake

- **Moderate** level of effect for disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics during construction for the Baseline and Likely Future Ecological Environment.

The post mitigation level of effect is considered to be **Very Low** for construction related effects.

9.2.3.2 Operational Effects

Long-tailed bats

- **Moderate** level of effect for the loss in connectivity due to the presence of the road resulting in changes to the population dynamics during operation for the Baseline and Likely Future Ecological Environment.

The post mitigation level of effect is considered to be **Very Low** for operational related effects.

Spotless crake

- **Moderate** level of effect for disturbance and displacement to nests and individuals of (new and existing) due to the presence of the infrastructure (noise, light, vibration etc) resulting in changes to the population dynamics during operation for the Baseline and Likely Future Ecological Environment.

The post mitigation level of effect is considered to be **Very Low** for operational related effects.

10 NOR 4: Matakana Road Upgrade

This section assesses specific ecological matters relating to NOR 4 - Matakana Road Upgrade.

10.1 Overview and Description of Works

The Project proposes the upgrade of Matakana Road to a two lane urban arterial cross-section with cycle lanes and footpaths the corridor.

NOR 4 follows a north south alignment and runs along a watershed of several small catchments draining into the Mahurangi River. The northern section of the NOR is associated with several headwater seep wetlands and intermittent streams in a pasture setting. The central and southern parts of the NOR is associated with a peri-urban landscape, characterised by road side planting and treelands (exotic and native). The southernmost section is flanked by two SEAs; SEA_T_5440 to the east and SEA_T_2260 to the west.

Key features of the proposed upgrade include the following:

- Upgrading Matakana Road to include cycle lanes and footpaths on the corridor.
- Tie-ins with existing roads, stormwater dry ponds, wetlands, and culverts.
- Likely posted speed of 50 kph, design speed (of which effects will be assessed on) is 60 kph.
- Batter slopes to enable widening of the corridor, and associated cut and fill activities.
- Vegetation removal along the existing road corridor.
- Other construction related activities required outside the permanent corridor including the re-grade of driveways, construction traffic manoeuvring and construction laydown areas.

Refer to the AEE for a more detailed description of works to be authorised.

10.2 Assessment of Ecological Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

Section 10.2 assesses the ecological effects of activities which relate to district plan matters under the AUP:OP.

10.2.1 Construction Effects - Terrestrial Ecology

Refer to Section 8.2.1.

10.2.1.1 Long-tailed bats

Bats may utilise the freshwater habitats located adjacent to NOR 4 (WW5-S1 and the permanent stream located in SEA_T_2260 south of the NOR) for foraging. Additionally, bats may utilise the terrestrial habitats for foraging and roosting, specifically areas of Kahikatea Forest (MF4), Native-Dominated Treeland (TL.1), Mixed Native/Exotic Treeland (TL.2), Exotic-Dominated Treeland (TL.3), Kānuka Scrub/Forest (VS2), and Tawa, Kohekohe, Rewarewa, Hīnau, Podocarp Forest (WF13). During construction of the Project, night works may be required, and site compounds are likely to be lit overnight. Lighting at night has the potential to modify the behaviour of bats if foraging within this area or roosting in nearby isolated stands of mature trees. Noise and vibration during construction can be an issue if bats are roosting in the immediate vicinity of the construction works.

Table 10-1 outlines the effect assessment for long-tailed bats due to construction activities related to noise, light, dust, vibration etc.

Table 10-1 Assessment of ecological effects for long-tailed bats and impact management during construction for NOR 4

Effect Description	Disturbance and displacement to roosts and individual bats (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Low** due to the relatively short duration and likely probability of construction related effects. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. **As such impact management is required**.	Same as Baseline due to the retention of vegetation within riparian corridors. Vegetation associated with adjacent Significant Ecological Areas is also anticipated to remain in the Likely Future Ecological Environment, Additionally, some areas of the NOR may also provide bat habitat if construction occurs prior to urbanisation. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.
Impact management and residual level of effect	A Bat Management Plan (BMP) should be developed to include consideration for: • Surveys prior to construction to confirm presence/likely absence. Surveys to confirm bat roost locations if activity is confirmed. • Confirmation of maternity roosts may require a seasonal restriction on construction activity (no or restricted construction during Dec-Mar). • Siting of compounds and laydown areas to avoid MF4, TL.1, TL.2, TL,3 VS2, and WF13 habitat. • Lighting design to reduce light levels and spill from construction areas. • Restriction of nightworks around MF4, TL.1, TL.2, TL,3 VS2, and WF13 habitat. • Bat management should be incorporated with any regional consent conditions (i.e., BMPs) that may be required for regional compliance. The residual impact is assessed as **Very Low** post mitigation.	Same as Baseline.
Management of residual effect	N/A	N/A

10.2.1.2Avifauna

Noise, vibration, and lighting disturbance caused by construction activities could potentially displace native birds from suitable nesting and foraging habitat associated with NOR 4. Table 10-2 details the specific habitat that birds may be utilising in NOR 4.

Table 10-2 Potential habitat for avifauna in NOR 4

Species	Potential Habitat
Non-TAR birds	• All habitats, excluding Brown Field (BF)
New Zealand pipit	• Exotic Grass (EG)
North Island kākā	• Kahikatea Forest (MF4) • Native-Dominated Treeland (TL.1) • Mixed Native/Exotic Treeland (TL.2) • Exotic-Dominated Treeland (TL.3) • Kānuka Scrub/Forest (VS2) • Tawa, Kohekohe, Rewarewa, Hīnau, Podocarp Forest (WF13)
Long-tailed cuckoo	• Kahikatea Forest (MF4) • Native-Dominated Treeland (TL.1) • Mixed Native/Exotic Treeland (TL.2) • Exotic-Dominated Treeland (TL.3) • Kānuka Scrub/Forest (VS2) • Tawa, Kohekohe, Rewarewa, Hīnau, Podocarp Forest (WF13)
Australasian bittern	• Exotic Wetland (EW): - WW4-W1 - WW4-W2 - WW4-W3
Spotless crake	• Exotic Wetland (EW): - WW4-W1 - WW4-W2 - WW4-W3

Table 10-3 Assessment of ecological effects for avifauna and impact management during construction for NOR outlines the effect assessment for birds due to construction activities related to noise, light, dust, vibration etc.

Table 10-3 Assessment of ecological effects for avifauna and impact management during construction for NOR 4

Effect Description	Disturbance and displacement to nests and individual birds (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	**Non-TAR birds** The magnitude of effect is assessed as **Negligible** due to the relatively short duration and unlikely probability of construction related effects. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required. **New Zealand pipit** The magnitude of effect was adjusted to **Moderate** to ensure a mitigation control for New Zealand pipit. This is because New Zealand pipit may require specific management during construction to prevent disturbance to nesting birds in the area. The ecological value of this species is **High**, and the overall level of effect is assessed as **High** prior to mitigation. **As such impact management is required**. **Long-tailed cuckoo** The magnitude of effect is assessed as **Negligible** due to the relatively short duration and unlikely probability of construction related effects. The ecological value of this species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **North Island kākā**	The magnitude of effect and overall level of effect is considered the same as Baseline for the following bird species: • Non-TAR birds • Long-tailed cuckoo • North Island kākā • Australasian bittern • Spotless crake **New Zealand pipit** The magnitude of effect is assessed as **Negligible** due to the relatively short duration and unlikely probability of construction related effects. The ecological value of this species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.

Effect Description	Disturbance and displacement to nests and individual birds (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
	The magnitude of effect is assessed as **Negligible** due to the relatively short duration and unlikely probability of construction related effects. The ecological value of this species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Australasian bittern** The magnitude of effect is assessed as **Negligible** due to the relatively short duration and unlikely probability of construction related effects. The ecological value of this species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Spotless crake** The magnitude of effect was adjusted to **Low** to ensure a mitigation control for spotless crake. This is because spotless crake may require specific management during construction to prevent disturbance to nesting birds in the area. The ecological value of this species is **High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. **As such impact management is required**.	
Impact management and residual level of effect	**New Zealand pipit** An Avifauna Management Plan for New Zealand pipit should be developed to include consideration for: • Pre-construction nesting bird surveys in suitable habitat (EG, ES). • Timing consideration for construction works (avoiding breeding season, where practicable).	**Spotless crake** An Avifauna Management Plan for spotless crake should be developed to include consideration for: • Pre-construction nesting bird surveys at wetlands WW4-W1, WW4-W2, and WW4-W3.

Effect Description	Disturbance and displacement to nests and individual birds (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
	• Methods to minimise disturbance if the breeding season cannot be avoided. The residual impact is assessed as **Low** post mitigation. **<u>Spotless crake</u>** An Avifauna Management Plan for spotless crake should be developed to include consideration for: • Pre-construction nesting bird surveys at wetlands WW4-W1, WW4-W2, and WW4-W3. • Timing consideration for construction works (avoiding breeding season, where practicable). • Methods to protect and buffer nesting birds (if present). The residual impact is assessed as **Very Low** post mitigation.	• Timing consideration for construction works (avoiding breeding season, where practicable). • Methods to protect and buffer nesting birds (if present). The residual impact is assessed as **Very Low** post mitigation.
Management of residual effect	N/A	N/A

10.2.1.3Herpetofauna

Noise, vibration, and lighting disturbance caused by construction activities could potentially displace native herpetofauna from suitable habitat associated with NOR 4. Table 10-4 details the specific habitat that herpetofauna may be utilising in NOR 4.

Table 10-4 Potential habitat for herpetofauna in NOR 4

Species	Potential Habitat
Copper skink	• All habitats where there is suitable understorey, excluding Brown Field (BF)
Ornate skink	• All habitats contiguous to native forest or scrub and where there is suitable understorey, excluding Brown Field (BF)
Elegant gecko	• Kahikatea Forest (MF4) • Kānuka Scrub/Forest (VS2) • Tawa, Kohekohe, Rewarewa, Hīnau, Podocarp Forest (WF13)
Forest gecko	• Kahikatea Forest (MF4) • Kānuka Scrub/Forest (VS2) • Tawa, Kohekohe, Rewarewa, Hīnau, Podocarp Forest (WF13)
Pacific gecko	• Kahikatea Forest (MF4) • Kānuka Scrub/Forest (VS2) • Tawa, Kohekohe, Rewarewa, Hīnau, Podocarp Forest (WF13)
Hochstetter's frog	• Permanent streams: - WW5-S1 (located east of NOR 4) - Permanent stream in SEA_T_2260 (located south of NOR 4)

Table 10-5 Assessment of ecological effects for herpetofauna and impact management during construction for NOR outlines the effect assessment for herpetofauna due to construction activities related to noise, light, dust, vibration etc.

Table 10-5 Assessment of ecological effects for herpetofauna and impact management during construction for NOR 4

Effect Description	Disturbance and displacement of individuals (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	**Copper skink, ornate skink** The magnitude of effect is assessed as **Negligible** due to the local extent and unlikely probability of construction related effects. The ecological value of these species is assessed as **High**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Elegant gecko, forest gecko** The magnitude of effect is assessed as **Low** due to the local extent and likely probability of construction related effects. The ecological value of these species is assessed as **High**, and the overall level of effect due to construction disturbance is assessed as **Low** prior to mitigation. As such no impact management is required. **Pacific gecko** The magnitude of effect is assessed as **Low** due to the local extent and likely probability of construction related effects. The ecological value of this species is assessed as **Moderate**, and the overall level of effect due to construction disturbance is assessed as **Low** prior to mitigation. As such no impact management is required. **Hochstetter's frog**	The magnitude of effect and overall level of effect is considered the same as Baseline for the following herpetofauna species: • Copper skink • Ornate skink • Hochstetter's frog **Elegant gecko, forest gecko** The magnitude of effect is assessed as **Negligible** due to the local extent and unlikely probability of construction related effects. The ecological value of these species is assessed as **High**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Pacific gecko** The magnitude of effect is assessed as **Negligible** due to the local extent and unlikely probability of construction related effects. The ecological value of this species is assessed as **Moderate**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.

Effect Description	Disturbance and displacement of individuals (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
	The magnitude of effect is assessed as **Negligible** due to the local extent and unlikely probability of construction related effects. The ecological value of this species is assessed as **High**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required.	
Impact management and residual level of effect	N/A	N/A
Management of residual effect	N/A	N/A

10.2.2 Operational Effects - Terrestrial Ecology

Refer to Section 7.2.2.

10.2.2.1 Long-tailed bats

The loss of connectivity through the presence of the road and associated disturbance such as operational noise, vibration, and light can lead to an overall reduction in size and quality of bat foraging habitat, it can impact on bat movement in the broader landscape and can potentially disturb nearby bat roosts (including maternity roosts). Lighting spillage from street lighting could also disturb commuting and foraging bats at night and adversely affect insect prey populations.

Table 10-6 outlines the operational effects assessment and impact management for bats.

Table 10-6 Assessment of ecological effects for long-tailed bats and impact management during operation for NOR 4

	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
Effect Description	**Baseline**	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Negligible** due to the relatively local extent of disturbance and unlikely probability of disturbance occurring. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Low** for the disturbance of individual bats and roosts. As such no impact management is required.	Same as Baseline due to the retention of vegetation within riparian corridors. Vegetation associated with adjacent Significant Ecological Areas is also anticipated to remain in the Likely Future Ecological Environment. Additionally, some areas of the NOR may also provide bat habitat if construction occurs prior to urbanisation. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.	The magnitude of effect is assessed as **Low** due to the likely probability of loss in connectivity. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Moderate** for loss in connectivity. **As such impact management is required**.	Same as Baseline due to the retention of vegetation within riparian corridors. Vegetation associated with adjacent Significant Ecological Areas is also anticipated to remain in the Likely Future Ecological Environment. Additionally, some areas of the NOR may also provide bat habitat if construction occurs prior to urbanisation. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.
Impact management and residual level of effect	N/A	N/A	A BMP should be developed with consideration to the indicative bat mitigation in Appendix 12 – Indicative Mitigation Areas[26]. The map indicates the location and extent of measures to mitigate	Same as Baseline.

[26] As verified by Dr Ian Davidson-Watts of Davidson-Watts Ecology (Pacific) Limited in Appendix 12 – Indicative Mitigation Areas

Effect Description	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
			potential connectivity effects and includes hop-overs/underpasses, buffer planting and existing mature tree features that will be retained, as well as indicating areas where early planting[27] (or planting of mature trees) will occur. The BMP should also have additional consideration for: • Lighting design to minimise light levels and light spill along the road corridor. • As an alternative to early restoration planting, restoration planting can make use of mature trees to achieve the same goal as early restoration planting. • Assumptions in the efficacy of the proposed mitigation will be addressed through an adaptive management framework that will outline bat activity	

Effect Description	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
			thresholds, robust monitoring, and potential corrective action. The residual impact is assessed as **Very Low** post mitigation.	
Management of residual effect	N/A	N/A	N/A	N/A

10.2.2.2Avifauna

Noise, vibration, and lighting disturbance caused by the presence of the road could potentially disturb and displace native birds from suitable nesting and foraging habitat within and adjacent to NOR 4 (refer to Section 10.2.1.2). Additionally, permanent habitat loss and operational noise, vibration, and light may also affect connectivity in the broader landscape.

Table 10-7 outlines the operational effects assessment and impact management for birds.

Table 10-7 Assessment of ecological effects for avifauna and impact management during operation for NOR 4

	Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
Effect Description	**Baseline**	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	**Non-TAR birds** The magnitude of effect is assessed as **Low**, due to the local extent of effect and unlikely probability of disturbance due to noise, light and vibration from the areas of new road. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **New Zealand pipit** The magnitude of effect is assessed as **Negligible,** due to the local extent of effect and unlikely probability of disturbance due to noise, light and vibration from the areas of new road. The ecological value of these species is **High**, and the overall	The magnitude of effect and overall level of effect is considered the same as Baseline for the following bird species: • Non-TAR birds • New Zealand pipit • Long-tailed cuckoo • North Island kākā • Australasian bittern • Spotless crake Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.	**Non-TAR birds** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **New Zealand pipit** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of these species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation.	The magnitude of effect and overall level of effect is considered the same as Baseline for the following bird species: • Non-TAR birds • New Zealand pipit • Long-tailed cuckoo • North Island kākā • Australasian bittern • Spotless crake Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.

Effect Description	Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Long-tailed cuckoo** The magnitude of effect is assessed as **Negligible,** due to the local extent of effect and unlikely probability of disturbance due to noise, light and vibration from the areas of new road. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **North Island kākā** The magnitude of effect is assessed as **Negligible,** due to the local extent of effect and unlikely probability of disturbance due to noise, light and vibration from the areas of new road.		As such no impact management is required. **Long-tailed cuckoo** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **North Island kākā** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of this species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation.	

Effect Description	Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	The ecological value of these species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Australasian bittern** The magnitude of effect is assessed as **Negligible,** due to the local extent of effect and unlikely probability of disturbance due to noise, light and vibration from the areas of new road. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Spotless crake** The magnitude of effect was adjusted to **Low** to ensure a mitigation control for spotless crake. This is because spotless crake may require specific management during		As such no impact management is required. **Australasian bittern** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Spotless crake** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of this species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation.	

Effect Description	Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	operation to prevent disturbance to nesting birds in the area. The ecological value of these species is **High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. **As such impact management is required**.		As such no impact management is required.	
Impact management and residual level of effect	**<u>Spotless crake</u>** An Avifauna Management Plan for spotless crake should be developed to include consideration for: • Retention of vegetation near wetland habitat, where practicable. • Buffer planting between the road alignment and suitable habitat adjacent to the road (specifically wetlands WW4-W1 and WW4-W2). The residual impact is assessed as **Very Low** post mitigation.	Same as Baseline.	N/A	N/A

Effect Description	Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
Management of residual effect	N/A	N/A	N/A	N/A

10.2.2.3 Herpetofauna

Suitable habitat was identified within the NOR boundary which could potentially support herpetofauna. Native herpetofauna require vegetated corridors to facilitate natural dispersal, although they are considered to be relatively resident species and do not require migration or large-scale movement to support reproduction, refuge and feeding.

As the majority of NOR 4 is an upgrade of an existing road, it is not expected to result in the additional fragmentation of herpetofauna habitat. Similarly, resident (existing and future) herpetofauna are likely to be habituated to disturbance such as noise, vibration, and lighting and no additional effect on herpetofauna is expected.

Table 10-8 outlines the operational effects assessment and impact management for herpetofauna.

Table 10-8 Assessment of ecological effects for herpetofauna and impact management during operation for NOR 4

Effect Description	Disturbance and displacement of existing and future herpetofauna due to light, noise, and vibration effects from the presence of the road		Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	**Copper skink, ornate skink** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and relatively local extent of disturbance if the effect occurs. The ecological value of these species is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Elegant gecko, forest gecko** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and relatively local extent of disturbance if the effect occurs. The ecological value of these species is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Very Low** prior to mitigation.	The magnitude of effect and overall level of effect is considered the same as Baseline for the following herpetofauna species: • Copper skink • Ornate skink • Elegant gecko • Forest gecko • Pacific gecko • Hochstetter's frog Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.	**Copper skink, ornate skink** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and relatively local extent of loss in connectivity if the effect occurs. The ecological value of these species is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Elegant gecko, forest gecko** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and relatively local extent of loss in connectivity if the effect occurs. The ecological value of these species is assessed to be **High**, and the overall level of effect due to the	The magnitude of effect and overall level of effect is considered the same as Baseline for the following herpetofauna species: • Copper skink • Ornate skink • Elegant gecko • Forest gecko • Pacific gecko • Hochstetter's frog Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.

Effect Description	Disturbance and displacement of existing and future herpetofauna due to light, noise, and vibration effects from the presence of the road		Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	As such no impact management is required. **Pacific gecko** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and relatively local extent of disturbance if the effect occurs. The ecological value of this species is assessed to be **Moderate**, and the overall level of effect due to the presence of the road is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Hochstetter's frog** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and relatively local extent of disturbance if the effect occurs. The ecological value of this species is assessed to be **High**, and the overall level of effect due to the		presence of the road is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Pacific gecko** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and relatively local extent of loss in connectivity if the effect occurs. The ecological value of this species is assessed to be **Moderate**, and the overall level of effect due to the presence of the road is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Hochstetter's frog** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and relatively local extent of loss in connectivity if the effect occurs.	

Effect Description	Disturbance and displacement of existing and future herpetofauna due to light, noise, and vibration effects from the presence of the road		Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	presence of the road is assessed as **Very Low** prior to mitigation. As such no impact management is required.		The ecological value of this species is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Very Low** prior to mitigation. As such no impact management is required.	
Impact management and residual level of effect	N/A	N/A	N/A	N/A
Management of residual effect	N/A	N/A	N/A	N/A

10.2.3 Effects Conclusions

The ecological level of effects assessed as **Moderate** or higher for NOR 4 are described in Sections 10.2.3.1 and 10.2.3.2.

10.2.3.1Construction Effects

Long-tailed bats

- **Moderate** level of for disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics during construction for the Baseline and Likely Future Ecological Environment.

New Zealand pipit

- **High** level of effect for disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics during construction for the Baseline only.

The post mitigation level of effect is considered to be **Low** for construction related effects.

Spotless crake

- **Moderate** level of effect for disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics during construction for the Baseline and Likely Future Ecological Environment.

The post mitigation level of effect is considered to be **Very Low** for construction related effects.

10.2.3.2Operational Effects

Long-tailed bats

- **Moderate** level of effect for the loss in connectivity due to the presence of the road resulting in changes to the population dynamics during operation for the Baseline and Likely Future Ecological Environment.

The post mitigation level of effect is considered to be **Very Low** for operational related effects.

Spotless crake

- **Moderate** level of effect for disturbance and displacement to nests and individuals of (new and existing) due to the presence of the infrastructure (noise, light, vibration etc) resulting in changes to the population dynamics during operation for the Baseline and Likely Future Ecological Environment.

The post mitigation level of effect is considered to be **Very Low** for operational related effects.

11 NOR 5: Sandspit Road Upgrade

This section assesses specific ecological matters relating to NOR 5 - Sandspit Road Upgrade.

11.1 Overview and Description of Works

The Project proposes the upgrade of Sandspit Road to a two lane urban arterial cross-section with cycle lanes and footpaths on both sides of the corridor.

NOR 5 generally follows an east west alignment. The western section crosses over two relatively large Mahurangi River tributaries (order 3 streams). The riparian area associated with both streams represent SEAs (SEA_T_5440 to the western most stream, north of Sandspit Rd and SEA_T_6684 on the second tributary to the south of Sandspit Road). Ecological features to the east of the quarry road include exotic shelterbelt, mature roadside planting and exotic grass within a pasture setting. Several relatively larger (exotic) seep wetlands are located to the south of NOR 5.

Key features of the proposed new road include the following:

- Upgrading Sandspit Road to accommodate a two-lane cross-section with cycle lanes and footpaths.
- Construction of two stream bridges.
- Tie-ins with existing roads, stormwater dry ponds, wetlands, and culverts.
- Likely posted speed of 50 kph, design speed (of which effects will be assessed on) is 60 kph.
- Batter slopes to enable widening of the corridor, and associated cut and fill activities.
- Vegetation removal along the existing road corridor.
- Other construction related activities required outside the permanent corridor including the re-grade of driveways, construction traffic manoeuvring and construction laydown areas.

Refer to the AEE for a more detailed description of works to be authorised.

11.2 Assessment of Ecological Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

Section 11.2 assesses the ecological effects of activities which relate to district plan matters under the AUP:OP.

11.2.1 Construction Effects - Terrestrial Ecology

Refer to Section 8.2.1.

11.2.1.1 Long-tailed bats

Bats may utilise the freshwater habitats located adjacent to NOR 5 (specifically WW5-S1, WW5-S2 and associated tributaries, and the permanent stream located in SEA_T_2260 south of the NOR) for foraging. Additionally, bats may utilise the terrestrial habitats for foraging and roosting, specifically areas of Kahikatea Forest (MF4), Mixed Native/Exotic Treeland (TL.2), Exotic-Dominated Treeland (TL.3), Kānuka Scrub/Forest (VS2), Pūriri Forest (alluvial terraces with recent free-draining soils) (WF7.1), and Kauri, Podocarp, Broadleaved Forest (WF11). During construction of the Project, night works may be required, and site compounds are likely to be lit overnight. Lighting at night has the

potential to modify the behaviour of bats if foraging within this area or roosting in nearby isolated stands of mature trees. Noise and vibration during construction can be an issue if bats are roosting in the immediate vicinity of the construction works.

Table 11-1 outlines the effect assessment for long-tailed bats due to construction activities related to noise, light, dust, vibration etc.

Table 11-1 Assessment of ecological effects for long-tailed bats and impact management during construction for NOR 5

Effect Description	Disturbance and displacement to roosts and individual bats (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Low** due to the relatively short duration and likely probability of construction related effects. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. **As such impact management is required**.	Same as Baseline due to the retention of vegetation within riparian corridors. Vegetation associated with adjacent Significant Ecological Areas is also anticipated to remain in the Likely Future Ecological Environment. Additionally, some areas of the NOR may also provide bat habitat if construction occurs prior to urbanisation. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.
Impact management and residual level of effect	A Bat Management Plan (BMP) should be developed to include consideration for: • Surveys prior to construction to confirm presence/likely absence. Surveys to confirm bat roost locations if activity is confirmed. • Confirmation of maternity roosts may require a seasonal restriction on construction activity (no or restricted construction during Dec-Mar). • Siting of compounds and laydown areas to avoid MF4, TL.2, TL.3, VS2, WF7.1, and WF11 habitat. • Lighting design to reduce light levels and spill from construction areas. • Restriction of nightworks around MF4, TL.2, TL.3, VS2, WF7.1, and WF11 habitat. • Bat management should be incorporated with any regional consent conditions (i.e., BMPs) that may be required for regional compliance. The residual impact is assessed as **Very Low** post mitigation.	Same as Baseline.
Management of residual effect	N/A	N/A

11.2.1.2Avifauna

Noise, vibration, and lighting disturbance caused by construction activities could potentially displace native birds from suitable nesting and foraging habitat associated with NOR 5. Table 11-2 details the specific habitat that birds may be utilising in NOR 5.

Table 11-2 Potential habitat for avifauna in NOR 5

Species	Potential Habitat
Non-TAR birds	• All habitats, excluding Brown Field (BF)
New Zealand pipit	• Exotic Grass (EG) • Exotic Scrub (ES)
North Island kākā	• Kahikatea Forest (MF4) • Mixed Native/Exotic Treeland (TL.2) • Exotic-Dominated Treeland (TL.3) • Kānuka Scrub/Forest (VS2) • Pūriri Forest (alluvial terraces with recent free draining soils) (WF7.1) • Kauri, Podocarp, Broadleaved Forest (WF11)
Long-tailed cuckoo	• Kahikatea Forest (MF4) • Mixed Native/Exotic Treeland (TL.2) • Exotic-Dominated Treeland (TL.3) • Kānuka Scrub/Forest (VS2) • Pūriri Forest (alluvial terraces with recent free draining soils) (WF7.1) • Kauri, Podocarp, Broadleaved Forest (WF11)
Australasian bittern	• Exotic Wetland (EW): - WW5-W2 - WW5-W3
Spotless crake	• Exotic Wetland (EW): - WW5-W2 - WW5-W3

Table 11-3 Assessment of ecological effects for avifauna and impact management during construction for NOR outlines the effect assessment for birds due to construction activities related to noise, light, dust, vibration etc.

Table 11-3 Assessment of ecological effects for avifauna and impact management during construction for NOR 5

Effect Description	Disturbance and displacement to nests and individual birds (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	**Non-TAR birds** The magnitude of effect is assessed as **Negligible** due to the relatively short duration and unlikely probability of construction related effects. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required. **New Zealand pipit** The magnitude of effect was adjusted to **Moderate** to ensure a mitigation control for New Zealand pipit. This is because New Zealand pipit may require specific management during construction to prevent disturbance to nesting birds in the area. The ecological value of this species is **High**, and the overall level of effect is assessed as **High** prior to mitigation. **As such impact management is required**. **Long-tailed cuckoo** The magnitude of effect is assessed as **Negligible** due to the relatively short duration and unlikely probability of construction related effects. The ecological value of this species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **North Island kākā**	The magnitude of effect and overall level of effect is considered the same as Baseline for the following bird species: • Non-TAR birds • Long-tailed cuckoo • North Island kākā • Australasian bittern • Spotless crake **New Zealand pipit** The magnitude of effect is assessed as **Negligible** due to the relatively short duration and unlikely probability of construction related effects. The ecological value of this species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.

Effect Description	Disturbance and displacement to nests and individual birds (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
	The magnitude of effect is assessed as **Negligible** due to the relatively short duration and unlikely probability of construction related effects. The ecological value of this species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Australasian bittern** The magnitude of effect is assessed as **Negligible** due to the relatively short duration and unlikely probability of construction related effects. The ecological value of this species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Spotless crake** The magnitude of effect was adjusted to **Low** to ensure a mitigation control for spotless crake. This is because spotless crake may require specific management during construction to prevent disturbance to nesting birds in the area. The ecological value of this species is **High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. **As such impact management is required**.	
Impact management and residual level of effect	**New Zealand pipit** An Avifauna Management Plan for New Zealand pipit should be developed to include consideration for: • Pre-construction nesting bird surveys in suitable habitat (EG, ES). • Timing consideration for construction works (avoiding breeding season, where practicable).	**Spotless crake** An Avifauna Management Plan for spotless crake should be developed to include consideration for: • Pre-construction nesting bird surveys at wetlands WW5-W2 and WW5-W3.

Effect Description	Disturbance and displacement to nests and individual birds (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
	• Methods to minimise disturbance if the breeding season cannot be avoided. The residual impact is assessed as **Low** post mitigation. **<u>Spotless crake</u>** An Avifauna Management Plan for spotless crake should be developed to include consideration for: • Pre-construction nesting bird surveys at wetlands WW5-W2 and WW5-W3. • Timing consideration for construction works (avoiding breeding season, where practicable). • Methods to protect and buffer nesting birds (if present). The residual impact is assessed as **Very Low** post mitigation.	• Timing consideration for construction works (avoiding breeding season, where practicable). • Methods to protect and buffer nesting birds (if present). The residual impact is assessed as **Very Low** post mitigation.
Management of residual effect	N/A	N/A

11.2.1.3Herpetofauna

Noise, vibration, and lighting disturbance caused by construction activities could potentially displace native herpetofauna from suitable habitat associated with NOR 5. Table 11-4 details the specific habitat that herpetofauna may be utilising in NOR 5.

Table 11-4 Potential habitat for herpetofauna in NOR 5

Species	Potential Habitat
Copper skink	• All habitats where there is suitable understorey, excluding Brown Field (BF)
Ornate skink	• All habitats contiguous to native forest or scrub and where there is suitable understorey, excluding Brown Field (BF)
Elegant gecko	• Kahikatea Forest (MF4) • Kānuka Scrub/Forest (VS2) • Pūriri Forest (alluvial terraces with recent free draining soils) (WF7.1) • Kauri, Podocarp, Broadleaved Forest (WF11)
Forest gecko	• Kahikatea Forest (MF4) • Kānuka Scrub/Forest (VS2) • Pūriri Forest (alluvial terraces with recent free draining soils) (WF7.1) • Kauri, Podocarp, Broadleaved Forest (WF11)
Pacific gecko	• Kahikatea Forest (MF4) • Kānuka Scrub/Forest (VS2) • Pūriri Forest (alluvial terraces with recent free draining soils) (WF7.1) • Kauri, Podocarp, Broadleaved Forest (WF11)
Hochstetter's frog	• Permanent streams: - WW5-S1

Table 11-5 Assessment of ecological effects for herpetofauna and impact management during construction for NOR outlines the effect assessment for herpetofauna due to construction activities related to noise, light, dust, vibration etc.

Table 11-5 Assessment of ecological effects for herpetofauna and impact management during construction for NOR 5

Effect Description	Disturbance and displacement of individuals (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	**Copper skink, ornate skink** The magnitude of effect is assessed as **Negligible** due to the local extent and unlikely probability of construction related effects. The ecological value of these species is assessed as **High**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Elegant gecko, forest gecko** The magnitude of effect is assessed as **Low** due to the local extent and likely probability of construction related effects. The ecological value of these species is assessed as **High**, and the overall level of effect due to construction disturbance is assessed as **Low** prior to mitigation. As such no impact management is required. **Pacific gecko** The magnitude of effect is assessed as **Low** due to the local extent and likely probability of construction related effects. The ecological value of this species is assessed as **Moderate**, and the overall level of effect due to construction disturbance is assessed as **Low** prior to mitigation. As such no impact management is required. **Hochstetter's frog**	The magnitude of effect and overall level of effect is considered the same as Baseline for the following herpetofauna species: • Copper skink • Ornate skink • Hochstetter's frog **Elegant gecko, forest gecko** The magnitude of effect is assessed as **Negligible** due to the local extent and unlikely probability of construction related effects. The ecological value of these species is assessed as **High**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Pacific gecko** The magnitude of effect is assessed as **Negligible** due to the local extent and unlikely probability of construction related effects. The ecological value of this species is assessed as **Moderate**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.

Effect Description	Disturbance and displacement of individuals (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
	The magnitude of effect is assessed as **Low** due to the local extent and highly likely probability of construction related effects. The ecological value of this species is assessed as **High**, and the overall level of effect due to construction disturbance is assessed as **Low** prior to mitigation. As such no impact management is required.	
Impact management and residual level of effect	N/A	N/A
Management of residual effect	N/A	N/A

11.2.2 Operational Effects - Terrestrial Ecology

Refer to Section 7.2.2.

11.2.2.1 Long-tailed bats

The loss of connectivity through the presence of the road and associated disturbance such as operational noise, vibration, and light can lead to an overall reduction in size and quality of bat foraging habitat, it can impact on bat movement in the broader landscape and can potentially disturb nearby bat roosts (including maternity roosts). Lighting spillage from street lighting could also disturb commuting and foraging bats at night and adversely affect insect prey populations.

Table 11-6 outlines the operational effects assessment and impact management for bats.

Table 11-6 Assessment of ecological effects for long-tailed bats and impact management during operation for NOR 5

Effect Description	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Negligible** due to the relatively local extent of disturbance and unlikely probability of disturbance occurring. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Low** for the disturbance of individual bats and roosts. **As such no impact management is required.**	Same as Baseline due to the retention of vegetation within riparian corridors. Vegetation associated with adjacent Significant Ecological Areas is also anticipated to remain in the Likely Future Ecological Environment, Additionally, some areas of the NOR may also provide bat habitat if construction occurs prior to urbanisation. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.	The magnitude of effect is assessed as **Low** due to the unlikely probability of loss in connectivity. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Moderate** for loss in connectivity. **As such impact management is required**.	Same as Baseline due to the retention of vegetation within riparian corridors. Vegetation associated with adjacent Significant Ecological Areas is also anticipated to remain in the Likely Future Ecological Environment, Additionally, some areas of the NOR may also provide bat habitat if construction occurs prior to urbanisation. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.
Impact management and residual level of effect	N/A	N/A	A BMP should be developed with consideration to the indicative bat mitigation in Appendix 12 – Indicative Mitigation Areas[28]. The map indicates the location and extent of measures to mitigate	Same as Baseline.

[28] As verified by Dr Ian Davidson-Watts of Davidson-Watts Ecology (Pacific) Limited in Appendix 12 – Indicative Mitigation Areas

Effect Description	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
			potential connectivity effects and includes hop-overs/underpasses, buffer planting and existing mature tree features that will be retained, as well as indicating areas where early planting[29] (or planting of mature trees) will occur. The BMP should also have additional consideration for: • Lighting design to minimise light levels and light spill along the road corridor. • As an alternative to early restoration planting, restoration planting can make use of mature trees to achieve the same goal as early restoration planting. • Assumptions in the efficacy of the proposed mitigation will be addressed through an adaptive management framework that will outline bat activity	

[25]This may be in addition to the buffer planting proposed in Appendix 12 and will depend on the presence and location of roosts at the time of construction. The requirement for planting mature trees (as buffer) to mitigate roost disturbance, will depend on the future context such as the location of known roosts, the presence of existing buffer and the feasibility of including other design consideration that can control disturbance effects.

Effect Description	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
			thresholds, robust monitoring, and potential corrective action. The residual impact is assessed as **Very Low** post mitigation.	
Management of residual effect	N/A	N/A	N/A	N/A

11.2.2.2Avifauna

Noise, vibration, and lighting disturbance caused by the presence of the road could potentially disturb and displace native birds from suitable nesting and foraging habitat within and adjacent to NOR 5 (refer to Section 11.2.1.2). Additionally, permanent habitat loss and operational noise, vibration, and light may also affect connectivity in the broader landscape.

Table 11-7 outlines the operational effects assessment and impact management for birds.

Table 11-7 Assessment of ecological effects for avifauna and impact management during operation for NOR 5

	Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
Effect Description	**Baseline**	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	**Non-TAR birds** The magnitude of effect is assessed as **Low**, due to the local extent of effect and unlikely probability of disturbance due to noise, light and vibration from the areas of new road. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **New Zealand pipit** The magnitude of effect is assessed as **Negligible,** due to the local extent of effect and unlikely probability of disturbance due to noise, light and vibration from the areas of new road. The ecological value of these species is **High**, and the overall	The magnitude of effect and overall level of effect is considered the same as Baseline for the following bird species: • Non-TAR birds • New Zealand pipit • Long-tailed cuckoo • North Island kākā • Australasian bittern • Spotless crake Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.	**Non-TAR birds** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **New Zealand pipit** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of these species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation.	The magnitude of effect and overall level of effect is considered the same as Baseline for the following bird species: • Non-TAR birds • New Zealand pipit • Long-tailed cuckoo • North Island kākā • Australasian bittern • Spotless crake Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.

Effect Description	Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Long-tailed cuckoo** The magnitude of effect is assessed as **Negligible,** due to the local extent of effect and unlikely probability of disturbance due to noise, light and vibration from the areas of new road. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **North Island kākā** The magnitude of effect is assessed as **Negligible,** due to the local extent of effect and unlikely probability of disturbance due to noise, light and vibration from the areas of new road.		As such no impact management is required. **Long-tailed cuckoo** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **North Island kākā** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of this species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation.	

Effect Description	Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	The ecological value of these species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Australasian bittern** The magnitude of effect is assessed as **Negligible,** due to the local extent of effect and unlikely probability of disturbance due to noise, light and vibration from the areas of new road. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Spotless crake** The magnitude of effect was adjusted to **Low** to ensure a mitigation control for spotless crake. This is because spotless crake may require specific management during		As such no impact management is required. **Australasian bittern** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Spotless crake** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of this species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation.	

Effect Description	Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	operation to prevent disturbance to nesting birds in the area. The ecological value of these species is **High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. **As such impact management is required**.		As such no impact management is required.	
Impact management and residual level of effect	**Spotless crake** An Avifauna Management Plan for spotless crake should be developed to include consideration for: • Retention of vegetation near wetland habitat, where practicable. • Buffer planting between the road alignment and suitable habitat adjacent to the road (specifically wetlands WW5-W2 and WW5-W3). The residual impact is assessed as **Very Low** post mitigation.	Same as Baseline.	N/A	N/A

Effect Description	Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
Management of residual effect	N/A	N/A	N/A	N/A

11.2.2.3Herpetofauna

Suitable habitat was identified within the NOR boundary which could potentially support herpetofauna. Native herpetofauna require vegetated corridors to facilitate natural dispersal, although they are considered to be relatively resident species and do not require migration or large-scale movement to support reproduction, refuge and feeding.

As the majority of NOR 5 is an upgrade of an existing road, it is not expected to result in the additional fragmentation of herpetofauna habitat. Similarly, resident (existing and future) herpetofauna are likely to be habituated to disturbance such as noise, vibration, and lighting and no additional effect on herpetofauna is expected.

Table 11-8 outlines the operational effects assessment and impact management for herpetofauna.

Table 11-8 Assessment of ecological effects for herpetofauna and impact management during operation for NOR 5

Effect Description	Disturbance and displacement of existing and future herpetofauna due to light, noise and vibration effects from the presence of the road		Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	**Copper skink, ornate skink** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and relatively local extent of disturbance if the effect occurs. The ecological value of these species is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Elegant gecko, forest gecko** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and relatively local extent of disturbance if the effect occurs. The ecological value of these species is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Very Low** prior to mitigation.	The magnitude of effect and overall level of effect is considered the same as Baseline for the following herpetofauna species: • Copper skink • Ornate skink • Elegant gecko • Forest gecko • Pacific gecko • Hochstetter's frog Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.	**Copper skink, ornate skink** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and relatively local extent of loss in connectivity if the effect occurs. The ecological value of these species is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Elegant gecko, forest gecko** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and relatively local extent of loss in connectivity if the effect occurs. The ecological value of these species is assessed to be **High**, and the overall level of effect due to the	The magnitude of effect and overall level of effect is considered the same as Baseline for the following herpetofauna species: • Copper skink • Ornate skink • Elegant gecko • Forest gecko • Pacific gecko **Hochstetter's frog** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and relatively local extent of loss in connectivity if the effect occurs. The ecological value of this species is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Very Low** prior to mitigation. As such no impact management is required.

Effect Description	Disturbance and displacement of existing and future herpetofauna due to light, noise and vibration effects from the presence of the road		Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	As such no impact management is required. **<u>Pacific gecko</u>** The magnitude of effect is assessed as **Low** due to the unlikely probability and relatively local extent of disturbance if the effect occurs. The ecological value of this species is assessed to be **Moderate**, and the overall level of effect due to the presence of the road is assessed as **Very Low** prior to mitigation. As such no impact management is required. **<u>Hochstetter's frog</u>** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and relatively local extent of disturbance if the effect occurs. The ecological value of this species is assessed to be **High**, and the overall level of effect due to the		presence of the road is assessed as **Very Low** prior to mitigation. As such no impact management is required. **<u>Pacific gecko</u>** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and relatively local extent of loss in connectivity if the effect occurs. The ecological value of this species is assessed to be **Moderate**, and the overall level of effect due to the presence of the road is assessed as **Very Low** prior to mitigation. As such no impact management is required. **<u>Hochstetter's frog</u>** The magnitude of effect is assessed as **Low** due to the likely probability and relatively local extent of loss in connectivity if the effect occurs.	Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.

Effect Description	Disturbance and displacement of existing and future herpetofauna due to light, noise and vibration effects from the presence of the road		Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	presence of the road is assessed as **Very Low** prior to mitigation. As such no impact management is required.		The ecological value of this species is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Low** prior to mitigation. As such no impact management is required.	
Impact management and residual level of effect	N/A	N/A	N/A	N/A
Management of residual effect	N/A	N/A	N/A	N/A

11.2.3 Effects Conclusions

The ecological level of effects assessed as **Moderate** or higher for NOR 5 are described in Sections 11.2.3.1 and 11.2.3.2.

11.2.3.1Construction Effects

Long-tailed bats

- **Moderate** level of for disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics during construction for the Baseline and Likely Future Ecological Environment.

New Zealand pipit

- **High** level of effect for disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics during construction for the Baseline only.

The post mitigation level of effect is considered to be **Low** for construction related effects.

Spotless crake

- **Moderate** level of effect for disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics during construction for the Baseline and Likely Future Ecological Environment.

The post mitigation level of effect is considered to be **Very Low** for construction related effects.

11.2.3.2Operational Effects

Long-tailed bats

- **Moderate** level of effect for the loss in connectivity due to the presence of the road resulting in changes to the population dynamics during operation for the Baseline and Likely Future Ecological Environment.

The post mitigation level of effect is considered to be **Very Low** for operational related effects.

Spotless crake

- **Moderate** level of effect for disturbance and displacement to nests and individuals of (new and existing) due to the presence of the infrastructure (noise, light, vibration etc) resulting in changes to the population dynamics during operation for the Baseline and Likely Future Ecological Environment.

The post mitigation level of effect is considered to be **Very Low** for operational related effects.

12 NOR 6: Western Link - South

This section assesses specific ecological matters relating to NOR 6 – New Western Link South.

12.1 Overview and Description of Works

The Project proposes a new two lane urban arterial cross-section with cycle lanes and footpaths on the corridor.

NOR 6 includes a new arterial linking Woodcock Road (through Jamie Lane in the west) to State Highway 1 in the east. The western portion of the road crosses an unnamed first order stream/wetland complex (tributary of the Mahurangi River), while the central and eastern sections align near the hilltop and avoids direct effects to several downslope headwater wetland systems.

Key features of the proposed new corridor include the following:

- The construction of a new two-lane urban arterial with walking and cycling facilities.
- Upgrading of intersection with McKinney Road.
- Likely posted speed of 50 kph, design speed (of which effects will be assessed on) is 60 kph.
- A bridge over the stream/wetland complex.
- Tie-ins with existing roads, stormwater wetland and culverts.
- Batter slopes to enable widening of the corridor, and associated cut and fill activities (earthworks).
- Vegetation removal along the existing road corridor.
- Other construction related activities required outside the permanent corridor including the re-grade of driveways, construction traffic manoeuvring and construction laydown areas.

Refer to the AEE for a more detailed description of works to be authorised.

12.2 Assessment of Ecological Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

Section 12.2 assesses the ecological effects of activities which relate to district plan matters under the AUP:OP.

12.2.1 Construction Effects - Terrestrial Ecology

Refer to Section 7.2.1.

12.2.1.1Long-tailed bats

Long-tailed bats may utilise the freshwater habitat associated with NOR 6 for foraging, and there is limited suitable roosting habitat present in the NOR (isolated stands/single trees of Exotic-Dominated Treeland (TL.3)). During construction of the Project, night works may be required, and site compounds are likely to be lit overnight. Lighting at night has the potential to modify the behaviour of bats if foraging within this area or roosting in nearby isolated stands of mature trees. Noise and vibration during construction can be an issue if bats are roosting in the immediate vicinity of the construction works.

Table 12-1 outlines the effect assessment for long-tailed bats due to construction activities related to noise, light, dust, vibration etc.

Table 12-1 Assessment of ecological effects for long-tailed bats and impact management during construction for NOR 6

Effect Description	Disturbance and displacement to roosts and individual bats (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Negligible** due to the relatively short duration and unlikely probability of construction related effects. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required.	Same as Baseline. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.
Impact management and residual level of effect	N/A	N/A
Management of residual effect	N/A	N/A

12.2.1.2Avifauna

Noise, vibration, and lighting disturbance caused by construction activities could potentially displace native birds from suitable nesting and foraging habitat associated with NOR 6. Table 12-2 details the specific habitat that birds may be utilising in NOR 6.

Table 12-2 Potential habitat for avifauna in NOR 6

Species	Potential Habitat
Non-TAR birds	• All habitats, excluding Brown Field (BF)
New Zealand pipit	• Exotic Grass (EG) • Exotic Scrub (ES)
Australasian bittern	• Exotic Wetland (EW): WW3-W1 • Raupō reedland (WL19): WW6-W1
Spotless crake	• Exotic Wetland (EW): WW3-W1 • Raupō reedland (WL19): WW6-W1

Table 12-3 Assessment of ecological effects for avifauna and impact management during construction for NOR outlines the effect assessment for birds due to construction activities related to noise, light, dust, vibration etc.

Table 12-3 Assessment of ecological effects for avifauna and impact management during construction for NOR 6

Effect Description	Disturbance and displacement to nests and individual birds (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	**Non-TAR birds** The magnitude of effect is assessed as **Low** due to the relatively short duration and highly likely probability of construction related effects. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required. **New Zealand pipit** The magnitude of effect was adjusted to **Moderate** to ensure a mitigation control for New Zealand pipit. This is because New Zealand pipit may require specific management during construction to prevent disturbance to nesting birds in the area. The ecological value of this species is **High**, and the overall level of effect is assessed as **High** prior to mitigation. **As such impact management is required**. **Australasian bittern** The magnitude of effect is assessed as **Negligible** due to the relatively short duration and unlikely probability of construction related effects. The ecological value of this species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Spotless crake** The magnitude of effect was adjusted to **Low** to ensure a mitigation control for spotless crake. This is because spotless crake may require specific	The magnitude of effect and overall level of effect is considered the same as Baseline for the following bird species: • Australasian bittern • Spotless crake **Non-TAR birds** The magnitude of effect is assessed as **Negligible** due to the relatively short duration and unlikely probability of construction related effects. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required. **New Zealand pipit** The magnitude of effect is assessed as **Negligible** due to the relatively short duration and unlikely probability of construction related effects. The ecological value of these species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.

Effect Description	Disturbance and displacement to nests and individual birds (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
	management during construction to prevent disturbance to nesting birds in the area. The ecological value of this species is **High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. **As such impact management is required**.	
Impact management and residual level of effect	**New Zealand pipit** An Avifauna Management Plan for New Zealand pipit should be developed to include consideration for: • Pre-construction nesting bird surveys in suitable habitat (EG, ES). • Timing consideration for construction works (avoiding breeding season, where practicable). • Methods to minimise disturbance if the breeding season cannot be avoided. The residual impact is assessed as **Low** post mitigation. **Spotless crake** An Avifauna Management Plan for spotless crake should be developed to include consideration for: • Pre-construction nesting bird surveys at wetlands WW3-W1 and WW6-W1. • Timing consideration for construction works (avoiding breeding season, where practicable). • Methods to protect and buffer nesting birds (if present). The residual impact is assessed as **Very Low** post mitigation.	**Spotless crake** An Avifauna Management Plan for spotless crake should be developed to include consideration for: • Pre-construction nesting bird surveys at wetlands WW3-W1 and WW6-W1. • Timing consideration for construction works (avoiding breeding season, where practicable). • Methods to protect and buffer nesting birds (if present). The residual impact is assessed as **Very Low** post mitigation.

Effect Description	Disturbance and displacement to nests and individual birds (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	Likely Future Ecological Environment
Management of residual effect	N/A	N/A

12.2.1.3Herpetofauna

Noise, vibration, and lighting disturbance caused by construction activities could potentially displace native herpetofauna from suitable habitat associated with NOR 6. Table 12-4 details the specific habitat that herpetofauna may be utilising in NOR 6.

Table 12-4 Potential habitat for herpetofauna in NOR 6

Species	Potential Habitat
Copper skink	• All habitats where there is suitable understorey, excluding Brown Field (BF)

Table 12-5 outlines the effect assessment for herpetofauna due to construction activities related to noise, light, dust, vibration etc.

Table 12-5 Assessment of ecological effects for herpetofauna and impact management during construction for NOR 6

Effect Description	Disturbance and displacement of individuals (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	Likely Future Ecological Environment
Level of effect prior to impact management	**Copper skink** The magnitude of effect is assessed as **Negligible** due to the local extent and unlikely probability of construction related effects. The ecological value of this species is assessed as **High**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required.	**Copper skink** Same as Baseline. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.
Impact management and residual level of effect	N/A	N/A
Management of residual effect	N/A	N/A

12.2.2 Operational Effects - Terrestrial Ecology

Refer to Section 7.2.2.

12.2.2.1Long-tailed bats

The loss of connectivity through the presence of the road and associated disturbance such as operational noise, vibration, and light can lead to an overall reduction in size and quality of bat foraging habitat, it can impact on bat movement in the broader landscape and can potentially disturb

nearby bat roosts (including maternity roosts). Lighting spillage from street lighting could also disturb commuting and foraging bats at night and adversely affect insect prey populations.

Table 12-6 outlines the operational effects assessment and impact management for bats.

Table 12-6 Assessment of ecological effects for long-tailed bats and impact management during operation for NOR 6

	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
Effect Description	**Baseline**	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Negligible** due to the relatively local extent of disturbance and unlikely probability of disturbance occurring. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Low** for the disturbance of individual bats and roosts. As such no impact management is required.	Same as Baseline. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.	The magnitude of effect is assessed as **Negligible** due to the unlikely probability of loss in connectivity. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Low** for loss in connectivity. As such no impact management is required.	Same as Baseline. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.
Impact management and residual level of effect	N/A	N/A	N/A	N/A
Management of residual effect	N/A	N/A	N/A	N/A

12.2.2.2Avifauna

Noise, vibration, and lighting disturbance caused by the presence of the road could potentially disturb and displace native birds from suitable nesting and foraging habitat within and adjacent to NOR 6 (refer to Section 12.2.1.2). Additionally, permanent habitat loss and operational noise, vibration, and light may also affect connectivity in the broader landscape.

Table 12-7 outlines the operational effects assessment and impact management for birds.

Table 12-7 Assessment of ecological effects for avifauna and impact management during operation for NOR 6

	Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
Effect Description	**Baseline**	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	**Non-TAR birds** The magnitude of effect is assessed as **Moderate**, due to the local extent of effect and highly likely probability of disturbance due to noise, light and vibration from the areas of new road. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **New Zealand pipit** The magnitude of effect is assessed as **Low,** due to the local extent of effect and likely probability of disturbance due to noise, light and vibration from the areas of new road. The ecological value of these species is **High**, and the overall	The magnitude of effect and overall level of effect is considered the same as Baseline for the following bird species: • Australasian bittern • Spotless crake **Non-TAR birds** The magnitude of effect is assessed as **Low**, due to the local extent of effect and unlikely probability of disturbance due to noise, light and vibration from the areas of new road. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **New Zealand pipit** The magnitude of effect is assessed as **Negligible,** due to the local	**Non-TAR birds** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **New Zealand pipit** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of these species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation.	The magnitude of effect and overall level of effect is considered the same as Baseline for the following bird species: • Non-TAR birds • New Zealand pipit • Australasian bittern • Spotless crake Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.

Effect Description	Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **<u>Australasian bittern</u>** The magnitude of effect is assessed as **Negligible,** due to the local extent of effect and unlikely probability of disturbance due to noise, light and vibration from the areas of new road. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **<u>Spotless crake</u>** The magnitude of effect was adjusted to **Low** to ensure a mitigation control for spotless crake. This is because spotless crake may require specific management during	extent of effect and unlikely probability of disturbance due to noise, light and vibration from the areas of new road. The ecological value of these species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.	As such no impact management is required. **<u>Australasian bittern</u>** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **<u>Spotless crake</u>** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of this species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation.	

Effect Description	Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	operation to prevent disturbance to nesting birds in the area. The ecological value of these species is **High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. **As such impact management is required**.		As such no impact management is required.	
Impact management and residual level of effect	**Spotless crake** An Avifauna Management Plan for spotless crake should be developed to include consideration for: • Retention of vegetation near wetland habitat, where practicable. • Buffer planting between the road alignment and suitable habitat adjacent to the road (specifically wetlands WW3-W1 and WW6-W1). The residual impact is assessed as **Very Low** post mitigation.	Same as Baseline.	N/A	N/A

Effect Description	Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
Management of residual effect	N/A	N/A	N/A	N/A

12.2.2.3Herpetofauna

Suitable habitat was identified within the NOR boundary which could potentially support herpetofauna. Native herpetofauna require vegetated corridors to facilitate natural dispersal, although they are considered to be relatively resident species and do not require migration or large-scale movement to support reproduction, refuge and feeding.

As the majority of NOR 6 will be new infrastructure, it is likely that there will be some localised lizard disturbance from noise, vibration and lighting and fragmentation of lizard habitat for a period during operation.

Table 12-8 outlines the operational effects assessment and impact management for herpetofauna.

Table 12-8 Assessment of ecological effects for herpetofauna and impact management during operation for NOR 6

Effect Description	Disturbance and displacement of existing and future herpetofauna due to light, noise and vibration effects from the presence of the road		Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	**Copper skink** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and relatively local extent of disturbance if the effect occurs. The ecological value of this species is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Very Low** prior to mitigation. As such no impact management is required.	**Copper skink** Same as Baseline. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.	**Copper skink** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and relatively local extent of loss in connectivity if the effect occurs. The ecological value of this species is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Very Low** prior to mitigation. As such no impact management is required.	**Copper skink** Same as Baseline. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.
Impact management and residual level of effect	N/A	N/A	N/A	N/A
Management of residual effect	N/A	N/A	N/A	N/A

12.2.3 Effects Conclusions

The ecological level of effects assessed as **Moderate** or higher for NOR 6 are described in Sections 12.2.3.1 and 12.2.3.2.

12.2.3.1Construction Effects

New Zealand pipit

- **High** level of effect for disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics during construction for the Baseline only.

The post mitigation level of effect is considered to be **Low** for construction related effects.

Spotless crake

- **Moderate** level of effect for disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics during construction for the Baseline and Likely Future Ecological Environment.

The post mitigation level of effect is considered to be **Very Low** for construction related effects.

12.2.3.2Operational Effects

Spotless crake

- **Moderate** level of effect for disturbance and displacement to nests and individuals of (new and existing) due to the presence of the infrastructure (noise, light, vibration etc) resulting in changes to the population dynamics during operation for the Baseline and Likely Future Ecological Environment.

The post mitigation level of effect is considered to be **Very Low** for construction related effects.

13 NOR 7: Sandspit Link

This section assesses specific ecological matters relating to NOR 7 - Sandspit Link.

13.1 Overview and Description of Works

The Project proposes a new two lane urban arterial cross-section with cycle lanes and footpaths.

NOR 7 connects Matakana Road in the north to Sandspit Road to the south. The northern portion (greenfields) is associated with several seep wetlands, two patches of mature native forest (largely modified podocarp broadleaved forest dominated by totara canopy), mature exotic treeland and exotic grass. The southern portion aligns to the existing quarry road and is mostly associated with existing planting, shelterbelt, and exotic grass. The southern section includes a relatively large bridge extending over most of the floodplain and avoiding permanent impacts on two streams and associated wetlands.

Key features of the proposed new corridor include the following:

- Construction of a two-lane urban arterial with cycle lanes and footpaths.
- Likely posted speed of 50 kph, design speed (of which effects will be assessed on) is 60 kph.
- Tie-ins with existing roads, stormwater wetland and culverts.
- Batter slopes to enable widening of the corridor, and associated cut and fill activities (earthworks).
- Vegetation removal.
- Other construction related activities required outside the permanent corridor including the re-grade of driveways, construction traffic manoeuvring and construction laydown areas.

Refer to the AEE for a more detailed description of works to be authorised.

13.2 Assessment of Ecological Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

Section 13.2 assesses the ecological effects of activities which relate to district plan matters under the AUP:OP.

13.2.1 Construction Effects - Terrestrial Ecology

Refer to Section 7.2.1.

13.2.1.1 Long-tailed bats

Bats may utilise freshwater habitat associated with NOR 7 for foraging (all permanent streams in the NOR). Additionally, bats may utilise terrestrial habitat associated with the NOR for roosting and foraging, specifically areas of Kahikatea Forest (MF4), Native-Dominated Treeland (TL.1), Exotic-Dominated Treeland (TL.3), Pūriri Forest (alluvial terraces with recent free-draining soils) (WF7.1), and Kauri, Podocarp, Broadleaved Forest (WF11). During construction of the Project, night works may be required, and site compounds are likely to be lit overnight. Lighting at night has the potential to modify the behaviour of bats if foraging within this area or roosting in nearby isolated stands of mature trees. Noise and vibration during construction can be an issue if bats are roosting in the immediate vicinity of the construction works.

Table 13-1 outlines the effect assessment for long-tailed bats due to construction activities related to noise, light, dust, vibration etc.

Table 13-1 Assessment of ecological effects for long-tailed bats and impact management during construction for NOR 7

Effect Description	Disturbance and displacement to roosts and individual bats (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Low** due to the relatively short duration and highly likely probability of construction related effects. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. **As such impact management is required**.	Although the probability of construction related effects is considered likely, the magnitude of effect and overall level of effect are anticipated to be same as Baseline due to the retention of vegetation within riparian corridors. Vegetation associated with adjacent Significant Ecological Areas is also anticipated to remain in the Likely Future Ecological Environment, Additionally, some areas of the NOR may also provide bat habitat if construction occurs prior to urbanisation. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.
Impact management and residual level of effect	A Bat Management Plan (BMP) should be developed to include consideration for: • Surveys prior to construction to confirm presence/likely absence. Surveys to confirm bat roost locations if activity is confirmed. • Confirmation of maternity roosts may require a seasonal restriction on construction activity (no or restricted construction during Dec-Mar). • Siting of compounds and laydown areas to avoid MF4, TL.1, TL.3, WF7.1, and WF11 habitat. • Lighting design to reduce light levels and spill from construction areas. • Restriction of nightworks around MF4, TL.1, TL.3, WF7.1, and WF11 habitat. • Bat management should be incorporated with any regional consent conditions (i.e., BMPs) that may be required for regional compliance. The residual impact is assessed as **Very Low** post mitigation.	Same as Baseline.
Management of residual effect	N/A	N/A

13.2.1.2Avifauna

Noise, vibration, and lighting disturbance caused by construction activities could potentially displace native birds from suitable nesting and foraging habitat associated with NOR 7. Table 13-2 details the specific habitat that birds may be utilising in NOR 7.

Table 13-2 Potential habitat for avifauna in NOR 7

Species	Potential Habitat
Non-TAR birds	• All habitats, excluding Brown Field (BF)
New Zealand pipit	• Exotic Grass (EG)
North Island kākā	• Kahikatea Forest (MF4) • Native-Dominated Treeland (TL.1) • Exotic-Dominated Treeland (TL.3) • Pūriri Forest (alluvial terraces with recent free-draining soils) (WF7.1) • Kauri, Podocarp, Broadleaved Forest (WF11).
Long-tailed cuckoo	• Kahikatea Forest (MF4) • Native-Dominated Treeland (TL.1) • Exotic-Dominated Treeland (TL.3) • Pūriri Forest (alluvial terraces with recent free-draining soils) (WF7.1) • Kauri, Podocarp, Broadleaved Forest (WF11).
Black shag	• Permanent streams and their associated tributaries: - WW7-S2a - WW7-S3a - WW7-S4 - WW5-S2
Little black shag	• Permanent streams and their associated tributaries: - WW7-S2a - WW7-S3a - WW7-S4 - WW5-S2
Little shag	• Permanent streams and their associated tributaries: - WW7-S2a - WW7-S3a - WW7-S4 - WW5-S2
Pied shag	• Permanent streams and their associated tributaries: - WW7-S2a - WW7-S3a - WW7-S4

Species	Potential Habitat
	- WW5-S2
Australasian bittern	• Exotic Wetland (EW): WW7-W3
Spotless crake	• Exotic Wetland (EW): WW7-W3

Table 13-3 Assessment of ecological effects for avifauna and impact management during construction for NOR outlines the effect assessment for birds due to construction activities related to noise, light, dust, vibration etc.

Table 13-3 Assessment of ecological effects for avifauna and impact management during construction for NOR 7

Effect Description	Disturbance and displacement to nests and individual birds (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	**Non-TAR birds** The magnitude of effect is assessed as **Low** due to the relatively short duration and highly likely probability of construction related effects. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required. **New Zealand pipit** The magnitude of effect was adjusted to **Moderate** to ensure a mitigation control for New Zealand pipit. This is because New Zealand pipit may require specific management during construction to prevent disturbance to nesting birds in the area. The ecological value of this species is **High**, and the overall level of effect is assessed as **High** prior to mitigation. **As such impact management is required.** **Long-tailed cuckoo** The magnitude of effect is assessed as **Negligible** due to the relatively short duration and unlikely probability of construction related effects. The ecological value of this species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **North Island kākā**	The magnitude of effect and overall level of effect is considered the same as Baseline for the following bird species: • Long-tailed cuckoo • North Island kākā • Black shag • Little black shag • Pied shag • Little shag • Australasian bittern • Spotless crake **Non-TAR birds** The magnitude of effect is assessed as **Negligible** due to the relatively short duration and unlikely probability of construction related effects. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required. **New Zealand pipit** The magnitude of effect is assessed as **Negligible** due to the relatively short duration and unlikely probability of construction related effects. The ecological value of this species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required.

Effect Description	Disturbance and displacement to nests and individual birds (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
	The magnitude of effect is assessed as **Negligible** due to the relatively short duration and unlikely probability of construction related effects. The ecological value of this species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Black shag, little black shag, pied shag, little shag** The magnitude of effect is assessed as **Negligible** due to the relatively short duration and unlikely probability of construction related effects. The ecological value of this species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Australasian bittern** The magnitude of effect is assessed as **Negligible** due to the relatively short duration and unlikely probability of construction related effects. The ecological value of this species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Spotless crake** The magnitude of effect was adjusted to **Low** to ensure a mitigation control for spotless crake. This is because spotless crake may require specific management during construction to prevent disturbance to nesting birds in the area. The ecological value of this species is **High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. **As such impact management is required**.	Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.

Effect Description	Disturbance and displacement to nests and individual birds (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
Impact management and residual level of effect	**New Zealand pipit** An Avifauna Management Plan for New Zealand pipit should be developed to include consideration for: • Pre-construction nesting bird surveys in suitable habitat (EG, ES). • Timing consideration for construction works (avoiding breeding season, where practicable). • Methods to minimise disturbance if the breeding season cannot be avoided. The residual impact is assessed as **Low** post mitigation. **Spotless crake** An Avifauna Management Plan for spotless crake should be developed to include consideration for: • Pre-construction nesting bird surveys at wetland WW7-W3. • Timing consideration for construction works (avoiding breeding season, where practicable). • Methods to protect and buffer nesting birds (if present). The residual impact is assessed as **Very Low** post mitigation.	**Spotless crake** An Avifauna Management Plan for spotless crake should be developed to include consideration for: • Pre-construction nesting bird surveys at wetland WW7-W3. • Timing consideration for construction works (avoiding breeding season, where practicable). • Methods to protect and buffer nesting birds (if present). The residual impact is assessed as **Very Low** post mitigation.
Management of residual effect	N/A	N/A

13.2.1.3Herpetofauna

Noise, vibration, and lighting disturbance caused by construction activities could potentially displace native herpetofauna from suitable habitat associated with NOR 7. Table 13-4 details the specific habitat that herpetofauna may be utilising in NOR 7.

Table 13-4 Potential habitat for herpetofauna in NOR 7

Species	Potential Habitat
Copper skink	• All habitats where there is suitable understorey, excluding Brown Field (BF)
Ornate skink	• All habitats contiguous to native forest or scrub and where there is suitable understorey, excluding Brown Field (BF)
Elegant gecko	• Kahikatea Forest (MF4) • Pūriri Forest (alluvial terraces with recent free-draining soils) (WF7.1) • Kauri, Podocarp, Broadleaved Forest (WF11)
Forest gecko	• Kahikatea Forest (MF4) • Pūriri Forest (alluvial terraces with recent free-draining soils) (WF7.1) • Kauri, Podocarp, Broadleaved Forest (WF11)
Pacific gecko	• Kahikatea Forest (MF4) • Pūriri Forest (alluvial terraces with recent free-draining soils) (WF7.1) • Kauri, Podocarp, Broadleaved Forest (WF11)
Hochstetter's frog	• Permanent streams: - WW7-S4

Table 13-5 Assessment of ecological effects for herpetofauna and impact management during construction for NOR outlines the effect assessment for herpetofauna due to construction activities related to noise, light, dust, vibration etc.

Table 13-5 Assessment of ecological effects for herpetofauna and impact management during construction for NOR 7

Effect Description	Disturbance and displacement of individuals (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	**Copper skink, ornate skink** The magnitude of effect is assessed as **Low** due to the local extent and likely probability of construction related effects. The ecological value of these species is assessed as **High**, and the overall level of effect due to construction disturbance is assessed as **Low** prior to mitigation. As such no impact management is required. **Elegant gecko, forest gecko** The magnitude of effect is assessed as **Low** due to the local extent and highly likely probability of construction related effects. The ecological value of these species is assessed as **High**, and the overall level of effect due to construction disturbance is assessed as **Low** prior to mitigation. As such no impact management is required. **Pacific gecko** The magnitude of effect is assessed as **Low** due to the local extent and highly likely probability of construction related effects. The ecological value of this species is assessed as **Moderate**, and the overall level of effect due to construction disturbance is assessed as **Low** prior to mitigation. As such no impact management is required. **Hochstetter's frog**	**Copper skink, ornate skink** The magnitude of effect is assessed as **Negligible** due to the local extent and unlikely probability of construction related effects. The ecological value of these species is assessed as **High**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Elegant gecko, forest gecko** The magnitude of effect is assessed as **Negligible** due to the local extent and unlikely probability of construction related effects. The ecological value of these species is assessed as **High**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Pacific gecko** The magnitude of effect is assessed as **Negligible** due to the local extent and unlikely probability of construction related effects. The ecological value of this species is assessed as **Moderate**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Hochstetter's frog**

Effect Description	Disturbance and displacement of individuals (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
	The magnitude of effect is assessed as **Low** due to the local extent and likely probability of construction related effects. The ecological value of this species is assessed as **High**, and the overall level of effect due to construction disturbance is assessed as **Low** prior to mitigation. As such no impact management is required.	The magnitude of effect is assessed as **Negligible** due to the local extent and unlikely probability of construction related effects. The ecological value of this species is assessed as **High**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.
Impact management and residual level of effect	N/A	N/A
Management of residual effect	N/A	N/A

13.2.2 Operational Effects - Terrestrial Ecology

Refer to Section 7.2.2.

13.2.2.1 Long-tailed bats

The loss of connectivity through the presence of the road and associated disturbance such as operational noise, vibration, and light can lead to an overall reduction in size and quality of bat foraging habitat, it can impact on bat movement in the broader landscape and can potentially disturb nearby bat roosts (including maternity roosts). Lighting spillage from street lighting could also disturb commuting and foraging bats at night and adversely affect insect prey populations.

Table 13-6 outlines the operational effects assessment and impact management for bats.

Table 13-6 Assessment of ecological effects for long-tailed bats and impact management during operation for NOR 7

	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
Effect Description	**Baseline**	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Low** due to the relatively local extent of disturbance and likely probability of disturbance occurring. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Moderate** for the disturbance of individual bats and roosts. **As such impact management is required**.	Same as Baseline due to the retention of vegetation within riparian corridors. Vegetation associated with adjacent Significant Ecological Areas is also anticipated to remain in the Likely Future Ecological Environment. Additionally, some areas of the NOR may also provide bat habitat if construction occurs prior to urbanisation. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.	The magnitude of effect is assessed as **Low** due to the likely probability of loss in connectivity. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Moderate** for loss in connectivity. **As such impact management is required**.	Same as Baseline due to the retention of vegetation within riparian corridors. Vegetation associated with adjacent Significant Ecological Areas is also anticipated to remain in the Likely Future Ecological Environment. Additionally, some areas of the NOR may also provide bat habitat if construction occurs prior to urbanisation. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.
Impact management and residual level of effect	A Bat Management Plan (BMP) should be developed to include consideration for: • Early-stage/mature buffer planting, late-stage buffer planting, and retention of existing mature trees between	Same as Baseline.	A BMP should be developed with consideration to the indicative bat mitigation in Appendix 12 – Indicative Mitigation Areas[31]. The map indicates the location and extent of measures to mitigate potential connectivity effects and	Same as Baseline.

[31] As verified by Dr Ian Davidson-Watts of Davidson-Watts Ecology (Pacific) Limited in Appendix 12 – Indicative Mitigation Areas.

Effect Description	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	the road alignment and features with potential for bat roosts[30]. • Light and noise management through design. • Future presence of roosts within the alignment (placement of flaps on features with high roost potential). The residual impact is assessed as **Very Low** post mitigation.		includes hop-overs/underpasses, buffer planting and existing mature tree features that will be retained, as well as indicating areas where early planting[32] (or planting of mature trees) will occur. The BMP should also have additional consideration for: • Lighting design to minimise light levels and light spill along the road corridor. • As an alternative to early restoration planting, restoration planting can make use of mature trees to achieve the same goal as early restoration planting. • Assumptions in the efficacy of the proposed mitigation will be addressed through an adaptive management framework that will outline bat activity	

[30] This may be in addition to the buffer planting proposed in Appendix 12 and will depend on the presence and location of roosts at the time of construction. The requirement for planting mature trees (as buffer) to mitigate roost disturbance, will depend on the future context such as the location of known roosts, the presence of existing buffer and the feasibility of including other design consideration that can control disturbance effects.

Effect Description	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
			thresholds, robust monitoring, and potential corrective action. The residual impact is assessed as **Very Low** post mitigation.	
Management of residual effect	N/A	N/A	N/A	N/A

13.2.2.2Avifauna

Noise, vibration, and lighting disturbance caused by the presence of the road could potentially disturb and displace native birds from suitable nesting and foraging habitat within and adjacent to NOR 7 (refer to Section 13.2.1.2). Additionally, permanent habitat loss and operational noise, vibration, and light may also affect connectivity in the broader landscape.

Table 13-7 outlines the operational effects assessment and impact management for birds.

Table 13-7 Assessment of ecological effects for avifauna and impact management during operation for NOR 7

	Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
Effect Description	**Baseline**	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	**Non-TAR birds** The magnitude of effect is assessed as **Moderate**, due to the local extent of effect and highly likely probability of disturbance due to noise, light and vibration from the areas of new road. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **New Zealand pipit** The magnitude of effect is assessed as **Negligible,** due to the local extent of effect and unlikely probability of disturbance due to noise, light and vibration from the areas of new road. The ecological value of these species is **High**, and the overall	The magnitude of effect and overall level of effect is considered the same as Baseline for the following bird species: • New Zealand pipit • Long-tailed cuckoo • North Island kākā • Black shag • Little black shag • Pied shag • Little shag • Australasian bittern • Spotless crake **Non-TAR birds** The magnitude of effect is assessed as **Negligible**, due to the local extent of effect and unlikely probability of disturbance due to noise, light and vibration from the areas of new road. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall	**Non-TAR birds** The magnitude of effect is assessed as **Moderate** due to the local extent of effect and highly likely probability of loss in connectivity from the areas of new road. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **New Zealand pipit** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of these species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation.	The magnitude of effect and overall level of effect is considered the same as Baseline for the following bird species: • New Zealand pipit • Long-tailed cuckoo • North Island kākā • Black shag • Little black shag • Pied shag • Little shag • Australasian bittern • Spotless crake **Non-TAR birds** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall

Effect Description	Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **<u>Long-tailed cuckoo</u>** The magnitude of effect is assessed as **Negligible,** due to the local extent of effect and unlikely probability of disturbance due to noise, light and vibration from the areas of new road. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **<u>North Island kākā</u>** The magnitude of effect is assessed as **Negligible,** due to the local extent of effect and unlikely probability of disturbance due to noise, light and vibration from the areas of new road.	level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.	As such no impact management is required. **<u>Long-tailed cuckoo</u>** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **<u>North Island kākā</u>** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of this species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation.	level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.

Effect Description	Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	The ecological value of these species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **<u>Black shag, little black shag, pied shag, little shag</u>** The magnitude of effect is assessed as **Negligible,** due to the local extent of effect and unlikely probability of disturbance due to noise, light and vibration from the areas of new road. The ecological value of these species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **<u>Australasian bittern</u>** The magnitude of effect is assessed as **Negligible,** due to the local extent of effect and unlikely probability of disturbance due to		As such no impact management is required. **<u>Black shag, little black shag, pied shag, little shag</u>** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of this species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **<u>Australasian bittern</u>** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of these species is **Very High**, and the	

Effect Description	Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	noise, light and vibration from the areas of new road. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Spotless crake** The magnitude of effect was adjusted to **Low** to ensure a mitigation control for spotless crake. This is because spotless crake may require specific management during operation to prevent disturbance to nesting birds in the area. The ecological value of these species is **High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. **As such impact management is required**.		overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Spotless crake** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of this species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required.	
Impact management	**Spotless crake**	Same as Baseline.	N/A	N/A

Effect Description	Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
and residual level of effect	An Avifauna Management Plan for spotless crake should be developed to include consideration for: • Retention of vegetation near wetland habitat, where practicable. • Buffer planting between the road alignment and suitable habitat adjacent to the road (specifically wetland WW7-W3). The residual impact is assessed as **Very Low** post mitigation.			
Management of residual effect	N/A	N/A	N/A	N/A

13.2.2.3Herpetofauna

Suitable habitat was identified within the NOR boundary which could potentially support herpetofauna. Native herpetofauna require vegetated corridors to facilitate natural dispersal, although they are considered to be relatively resident species and do not require migration or large-scale movement to support reproduction, refuge and feeding.

As the majority of NOR 7 will be new infrastructure, it is likely that there will be some localised lizard disturbance from noise, vibration and lighting and fragmentation of lizard habitat for a period during operation.

Table 13-8 outlines the operational effects assessment and impact management for herpetofauna.

Table 13-8 Assessment of ecological effects for herpetofauna and impact management during operation for NOR 7

Effect Description	Disturbance and displacement of existing and future herpetofauna due to light, noise and vibration effects from the presence of the road		Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	**Copper skink, ornate skink** The magnitude of effect is assessed as **Low** due to the likely probability and relatively local extent of disturbance if the effect occurs. The ecological value of these species is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Low** prior to mitigation. As such no impact management is required. **Elegant gecko, forest gecko** The magnitude of effect is assessed as **Low** due to the likely probability and relatively local extent of disturbance if the effect occurs. The ecological value of these species is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Low** prior to mitigation.	**Copper skink, ornate skink** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and relatively local extent of disturbance if the effect occurs. The ecological value of these species is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Elegant gecko, forest gecko** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and relatively local extent of disturbance if the effect occurs. The ecological value of these species is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Very Low** prior to mitigation.	**Copper skink, ornate skink** The magnitude of effect is assessed as **Low** due to the likely probability and relatively local extent of loss in connectivity if the effect occurs. The ecological value of these species is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Low** prior to mitigation. As such no impact management is required. **Elegant gecko, forest gecko** The magnitude of effect is assessed as **Low** due to the likely probability and relatively local extent of loss in connectivity if the effect occurs. The ecological value of these species is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Low** prior to mitigation.	The magnitude of effect and overall level of effect is considered the same as Baseline for the following herpetofauna species: • Elegant gecko • Forest gecko • Pacific gecko • Hochstetter's frog **Copper skink, ornate skink** The magnitude of effect is assessed as Negligible due to the unlikely probability and relatively local extent of loss in connectivity if the effect occurs. The ecological value of these species is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Very Low** prior to mitigation. As such no impact management is required.

Effect Description	Disturbance and displacement of existing and future herpetofauna due to light, noise and vibration effects from the presence of the road		Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	As such no impact management is required. **Pacific gecko** The magnitude of effect is assessed as **Low** due to the likely probability and relatively local extent of disturbance if the effect occurs. The ecological value of this species is assessed to be **Moderate**, and the overall level of effect due to the presence of the road is assessed as **Low** prior to mitigation. As such no impact management is required. **Hochstetter's frog** The magnitude of effect is assessed as **Low** due to the likely probability and relatively local extent of disturbance if the effect occurs. The ecological value of this species is assessed to be **High**, and the overall level of effect due to the	As such no impact management is required. **Pacific gecko** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and relatively local extent of disturbance if the effect occurs. The ecological value of this species is assessed to be **Moderate**, and the overall level of effect due to the presence of the road is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Hochstetter's frog** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and relatively local extent of disturbance if the effect occurs. The ecological value of this species is assessed to be **High**, and the overall level of effect due to the	As such no impact management is required. **Pacific gecko** The magnitude of effect is assessed as **Low** due to the likely probability and relatively local extent of loss in connectivity if the effect occurs. The ecological value of this species is assessed to be **Moderate**, and the overall level of effect due to the presence of the road is assessed as **Low** prior to mitigation. As such no impact management is required. **Hochstetter's frog** The magnitude of effect is assessed as **Low** due to the likely probability and relatively local extent of loss in connectivity if the effect occurs. The ecological value of this species is assessed to be **High**, and the overall level of effect due to the	Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.

Effect Description	Disturbance and displacement of existing and future herpetofauna due to light, noise and vibration effects from the presence of the road		Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	presence of the road is assessed as **Low** prior to mitigation. As such no impact management is required.	presence of the road is assessed as **Very Low** prior to mitigation. As such no impact management is required. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.	presence of the road is assessed as **Low** prior to mitigation. As such no impact management is required.	
Impact management and residual level of effect	N/A	N/A	N/A	N/A
Management of residual effect	N/A	N/A	N/A	N/A

13.2.3 Effects Conclusions

The ecological level of effects assessed as **Moderate** or higher for NOR 7 are described in Sections 13.2.3.1 and 13.2.3.2.

13.2.3.1Construction Effects

Long-tailed bats

- **Moderate** level of for disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics during construction for the Baseline and Likely Future Ecological Environment.

New Zealand pipit

- **High** level of effect for disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics during construction for the Baseline only.

The post mitigation level of effect is considered to be **Low** for construction related effects.

Spotless crake

- **Moderate** level of effect for disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population

The post mitigation level of effect is considered to be **Very Low** for construction related effects.

13.2.3.2Operation Effects

Long-tailed bats

- **Moderate** level of effect for the loss in connectivity due to the presence of the road resulting in changes to the population dynamics during operation for the Baseline and Likely Future Ecological Environment.
- **Moderate** level of effect for disturbance and displacement to roosts and individuals of (new and existing) due to the presence of the infrastructure (noise, light, vibration etc) resulting in changes to the population dynamics during operation for the Baseline and Likely Future Ecological Environment.

The post mitigation level of effect is considered to be **Very Low** for operational related effects.

Spotless crake

- **Moderate** level of effect for disturbance and displacement to nests and individuals of (new and existing) due to the presence of the infrastructure (noise, light, vibration etc) resulting in changes to the population dynamics during operation for the Baseline and Likely Future Ecological Environment.

The post mitigation level of effect is considered to be **Very Low** for operational related effects.

14 NOR 8: Wider Western Link - North

This section assesses specific ecological matters relating to NOR 8 - Wider Western Link - North.

14.1 Overview and Description of Works

The Project proposes a new two lane urban arterial cross-section with cycle lanes and footpaths the corridor.

NOR 8 aligns south from Woodcocks Road before turning eastward towards State Highway 1. The northern most section incorporates a section of the existing Wyllie Rd, while the rest of this NOR is greenfield. After turning away from Wyllie Road, the NOR crosses over pasture and a native planted wetland. The central portion is associated with exotic pasture while the south-eastern portion crosses a first order stream and floodplain wetlands of the Mahurangi River (left branch). The majority of the floodplain will be bridged. The riparian vegetation associated with the Mahurangi River is generally consistent with semi-mature regenerative forest (kānuka/mānuka).

Key design features of the proposed new corridor include the following:

- Construction of a two-lane urban arterial with walking and cycling facilities the corridor.
- Likely posted speed of 50 kph, design speed (of which effects will be assessed on) is 60 kph.
- Tie-ins with existing roads (intersections with Woodcocks Road and SH1), stormwater wetland and culverts.
- Batter slopes and associated cut and fill activities (earthworks).
- Vegetation removal.
- Crossing of the Mahurangi River.
- Other construction related activities required outside the permanent corridor including construction traffic manoeuvring and construction laydown areas.

Refer to the AEE for a more detailed description of works to be authorised.

14.2 Assessment of Ecological Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

Section 14.2 assesses the ecological effects of activities which relate to district plan matters under the AUP:OP.

14.2.1 Construction Effects - Terrestrial Ecology

Refer to Section 7.2.1.

14.2.1.1 Long-tailed bats

Bats may utilise freshwater habitat associated with NOR 8 for foraging, specifically the Mahurangi River (Right Branch) (WW8-S3) and associated tributaries. Additionally, bats may utilise terrestrial habitat associated with the NOR for roosting and foraging, specifically areas of Exotic-Dominated Treeland (TL.3), Kānuka Scrub/Forest (VS2), and Pūriri Forest (WF7). During construction of the Project, night works may be required, and site compounds are likely to be lit overnight. Lighting at night has the potential to modify the behaviour of bats if foraging within this area or roosting in nearby

isolated stands of mature trees. Noise and vibration during construction can be an issue if bats are roosting in the immediate vicinity of the construction works.

Table 14-1 outlines the effect assessment for long-tailed bats due to construction activities related to noise, light, dust, vibration etc.

Table 14-1 Assessment of ecological effects for long-tailed bats and impact management during construction for NOR 8

Effect Description	Disturbance and displacement to roosts and individual bats (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Low** due to the relatively short duration and likely probability of construction related effects. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. **As such impact management is required**.	Same as Baseline due to the retention of vegetation within riparian corridors. Additionally, some areas of the NOR may also provide bat habitat if construction occurs prior to urbanisation. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.
Impact management and residual level of effect	A Bat Management Plan (BMP) should be developed to include consideration for: • Surveys prior to construction to confirm presence/likely absence. Surveys to confirm bat roost locations if activity is confirmed. • Confirmation of maternity roosts may require a seasonal restriction on construction activity (no or restricted construction during Dec-Mar). • Siting of compounds and laydown areas to avoid TL.3, VS2, and WF7 habitat. • Lighting design to reduce light levels and spill from construction areas. • Restriction of nightworks around TL.3, VS2, and WF7 habitat. • Bat management should be incorporated with any regional consent conditions (i.e., BMPs) that may be required for regional compliance. The residual impact is assessed as **Very Low** post mitigation.	Same as Baseline.
Management of residual effect	N/A	N/A

14.2.1.2Avifauna

Noise, vibration, and lighting disturbance caused by construction activities could potentially displace native birds from suitable nesting and foraging habitat associated with NOR 8. Table 14-2 details the specific habitat that birds may be utilising in NOR 8.

Table 14-2 Potential habitat for avifauna in NOR 8

Species	Potential Habitat
Non-TAR birds	• All habitats, excluding Brown Field (BF)
New Zealand pipit	• Exotic Grass (EG)
North Island kākā	• Exotic-Dominated Treeland (TL.3) • Kānuka Scrub/Forest (VS2) • Pūriri Forest (WF7)
Long-tailed cuckoo	• Exotic-Dominated Treeland (TL.3) • Kānuka Scrub/Forest (VS2) • Pūriri Forest (WF7)
Australasian bittern	• Planted Wetland (PLW): WW8-W1 • Exotic Wetland (EW): WW8-W4
Spotless crake	• Planted Wetland (PLW): WW8-W1 • Exotic Wetland (EW): WW8-W4
Dabchick	• Planted Wetland (PLW): WW8-W1

Table 14-3 Assessment of ecological effects for avifauna and impact management during construction for NOR outlines the effect assessment for birds due to construction activities related to noise, light, dust, vibration etc.

Table 14-3 Assessment of ecological effects for avifauna and impact management during construction for NOR 8

Effect Description	Disturbance and displacement to nests and individual birds (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	**Non-TAR birds** The magnitude of effect is assessed as **Low** due to the relatively short duration and highly likely probability of construction related effects. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required. **New Zealand pipit** The magnitude of effect was adjusted to **Moderate** to ensure a mitigation control for New Zealand pipit. This is because New Zealand pipit may require specific management during construction to prevent disturbance to nesting birds in the area. The ecological value of this species is **High**, and the overall level of effect is assessed as **High** prior to mitigation. **As such impact management is required**. **Long-tailed cuckoo** The magnitude of effect is assessed as **Negligible** due to the relatively short duration and unlikely probability of construction related effects. The ecological value of this species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **North Island kākā**	The magnitude of effect and overall level of effect is considered the same as Baseline for the following bird species: • Long-tailed cuckoo • North Island kākā • Australasian bittern • Spotless crake • Dabchick **Non-TAR birds** The magnitude of effect is assessed as **Negligible** due to the relatively short duration and unlikely probability of construction related effects. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required. **New Zealand pipit** The magnitude of effect is assessed as **Negligible** due to the relatively short duration and unlikely probability of construction related effects. The ecological value of this species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.

Effect Description	Disturbance and displacement to nests and individual birds (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
	The magnitude of effect is assessed as **Negligible** due to the relatively short duration and unlikely probability of construction related effects. The ecological value of this species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Australasian bittern** The magnitude of effect is assessed as **Negligible** due to the relatively short duration and unlikely probability of construction related effects. The ecological value of this species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Spotless crake** The magnitude of effect was adjusted to **Low** to ensure a mitigation control for spotless crake. This is because spotless crake may require specific management during construction to prevent disturbance to nesting birds in the area. The ecological value of this species is **High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. **As such impact management is required**. **Dabchick** The magnitude of effect is assessed as **Low** due to the relatively short duration and likely probability of construction related effects. The ecological value of this species is **Very High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. **As such impact management is required**.	

Effect Description	Disturbance and displacement to nests and individual birds (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
Impact management and residual level of effect	**New Zealand pipit** An Avifauna Management Plan for New Zealand pipit should be developed to include consideration for: • Pre-construction nesting bird surveys in suitable habitat (EG, ES). • Timing consideration for construction works (avoiding breeding season, where practicable). • Methods to minimise disturbance if the breeding season cannot be avoided. The residual impact is assessed as **Low** post mitigation. **Spotless crake** An Avifauna Management Plan for spotless crake should be developed to include consideration for: • Pre-construction nesting bird surveys at wetlands WW8-W1 and WW8-W4. • Timing consideration for construction works (avoiding breeding season, where practicable). • Methods to protect and buffer nesting birds (if present). The residual impact is assessed as **Very Low** post mitigation. **Dabchick** An Avifauna Management Plan for dabchick should be developed to include consideration for: • Pre-construction nesting bird surveys at wetland WW8-W1. • Timing consideration for construction works (avoiding breeding season, where practicable). • Methods to protect and buffer nesting birds (if present).	**Spotless crake** An Avifauna Management Plan for spotless crake should be developed to include consideration for: • Pre-construction nesting bird surveys at wetlands WW8-W1 and WW8-W4. • Timing consideration for construction works (avoiding breeding season, where practicable). • Methods to protect and buffer nesting birds (if present). The residual impact is assessed as **Very Low** post mitigation. **Dabchick** An Avifauna Management Plan for dabchick should be developed to include consideration for: • Pre-construction nesting bird surveys at wetland WW8-W1. • Timing consideration for construction works (avoiding breeding season, where practicable). • Methods to protect and buffer nesting birds (if present). The residual impact is assessed as **Very Low** post mitigation.

Effect Description	Disturbance and displacement to nests and individual birds (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
	The residual impact is assessed as **Low** post mitigation.	
Management of residual effect	N/A	N/A

14.2.1.3Herpetofauna

Noise, vibration, and lighting disturbance caused by construction activities could potentially displace native herpetofauna from suitable habitat associated with NOR 8. Table 14-4 details the specific habitat that herpetofauna may be utilising in NOR 8.

Table 14-4 Potential habitat for herpetofauna in NOR 8

Species	Potential Habitat
Copper skink	• All habitats where there is suitable understorey, excluding Brown Field (BF)
Ornate skink	• All habitats contiguous to native forest or scrub and where there is suitable understorey, excluding Brown Field (BF)
Elegant gecko	• Kānuka Scrub/Forest (VS2) • Pūriri Forest (WF7)
Forest gecko	• Kānuka Scrub/Forest (VS2) • Pūriri Forest (WF7)
Pacific gecko	• Kānuka Scrub/Forest (VS2) • Pūriri Forest (WF7)

Table 14-5 Assessment of ecological effects for herpetofauna and impact management during construction for NOR outlines the effect assessment for herpetofauna due to construction activities related to noise, light, dust, vibration etc.

Table 14-5 Assessment of ecological effects for herpetofauna and impact management during construction for NOR 8

Effect Description	Disturbance and displacement of individuals (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	Likely Future Ecological Environment
Level of effect prior to impact management	**Copper skink, ornate skink** The magnitude of effect is assessed as **Low** due to the local extent and likely probability of construction related effects. The ecological value of these species is assessed as **High**, and the overall level of effect due to construction disturbance is assessed as **Low** prior to mitigation. As such no impact management is required. **Elegant gecko, forest gecko** The magnitude of effect is assessed as **Low** due to the local extent and highly	**Copper skink, ornate skink** The magnitude of effect is assessed as **Negligible** due to the local extent and unlikely probability of construction related effects. The ecological value of these species is assessed as **High**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Elegant gecko, forest gecko**

Effect Description	Disturbance and displacement of individuals (existing) adjacent to construction activities (noise, light, dust, vibration etc.)	
	Baseline	**Likely Future Ecological Environment**
	likely probability of construction related effects. The ecological value of these species is assessed as **High**, and the overall level of effect due to construction disturbance is assessed as **Low** prior to mitigation. As such no impact management is required. **Pacific gecko** The magnitude of effect is assessed as **Low** due to the local extent and highly likely probability of construction related effects. The ecological value of this species is assessed as **Moderate**, and the overall level of effect due to construction disturbance is assessed as **Low** prior to mitigation. As such no impact management is required.	The magnitude of effect is assessed as **Negligible** due to the local extent and unlikely probability of construction related effects. The ecological value of these species is assessed as **High**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Pacific gecko** The magnitude of effect is assessed as **Negligible** due to the local extent and unlikely probability of construction related effects. The ecological value of this species is assessed as **Moderate**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.
Impact management and residual level of effect	N/A	N/A
Management of residual effect	N/A	N/A

14.2.2 Operational Effects - Terrestrial Ecology

Refer to Section 7.2.2.

14.2.2.1 Long-tailed bats

The loss of connectivity through the presence of the road and associated disturbance such as operational noise, vibration, and light can lead to an overall reduction in size and quality of bat foraging habitat, it can impact on bat movement in the broader landscape and can potentially disturb nearby bat roosts (including maternity roosts). Lighting spillage from street lighting could also disturb commuting and foraging bats at night and adversely affect insect prey populations.

Table 14-6 outlines the operational effects assessment and impact management for bats.

Table 14-6 Assessment of ecological effects for long-tailed bats and impact management during operation for NOR 8

	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
Effect Description	**Baseline**	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Low** due to the relatively local extent of disturbance and likely probability of disturbance occurring. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Moderate** for the disturbance of individual bats and roosts. **As such impact management is required**.	Same as Baseline due to the retention of vegetation within riparian corridors. Additionally, some areas of the NOR may also provide bat habitat if construction occurs prior to urbanisation. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.	The magnitude of effect is assessed as **High** due to the highly likely probability of loss in connectivity. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Very High** for loss in connectivity. **As such impact management is required**.	The magnitude of effect is assessed as **Moderate** due to the likely probability of loss in connectivity. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **High** for loss in connectivity. **As such impact management is required**. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.
Impact management and residual level of effect	A Bat Management Plan (BMP) should be developed to include consideration for: • Late-stage buffer planting, and retention of existing mature trees between the road	Same as Baseline.	A BMP should be developed with consideration to the indicative bat mitigation in Appendix 12 – Indicative Mitigation Areas[34]. The map indicates the location and extent of measures to mitigate potential connectivity effects and	Same as Baseline.

[34] As verified by Dr Ian Davidson-Watts of Davidson-Watts Ecology (Pacific) Limited in Appendix 12 – Indicative Mitigation Areas

Effect Description	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	alignment and features with potential for bat roosts[33]. • Light and noise management through design. • Future presence of roosts within the alignment (placement of flaps on features with high roost potential). The residual impact is assessed as **Very Low** post mitigation.		includes hop-overs/underpasses, buffer planting and existing mature tree features that will be retained, as well as indicating areas where early planting[35] (or planting of mature trees) will occur. The BMP should also have additional consideration for: • Lighting design to minimise light levels and light spill along the road corridor. • As an alternative to early restoration planting, restoration planting can make use of mature trees to achieve the same goal as early restoration planting. • Assumptions in the efficacy of the proposed mitigation will be addressed through an adaptive management framework that will outline bat activity	

[33] This may be in addition to the buffer planting proposed in Appendix 12 and will depend on the presence and location of roosts at the time of construction. The requirement for planting mature trees (as buffer) to mitigate roost disturbance, will depend on the future context such as the location of known roosts, the presence of existing buffer and the feasibility of including other design consideration that can control disturbance effects.

Effect Description	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
			thresholds, robust monitoring, and potential corrective action. The residual impact is assessed as **Low** post mitigation.	
Management of residual effect	N/A	N/A	N/A	N/A

14.2.2.2Avifauna

Noise, vibration, and lighting disturbance caused by the presence of the road could potentially disturb and displace native birds from suitable nesting and foraging habitat within and adjacent to NOR 8. (refer to Section 14.2.1.2) Additionally, permanent habitat loss and operational noise, vibration, and light may also affect connectivity in the broader landscape.

Table 14-7 outlines the operational effects assessment and impact management for birds.

Table 14-7 Assessment of ecological effects for avifauna and impact management during operation for NOR 8

	Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
Effect Description	**Baseline**	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	**Non-TAR birds** The magnitude of effect is assessed as **Moderate**, due to the local extent of effect and highly likely probability of disturbance due to noise, light and vibration from the areas of new road. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **New Zealand pipit** The magnitude of effect is assessed as **Negligible,** due to the local extent of effect and unlikely probability of disturbance due to noise, light and vibration from the areas of new road. The ecological value of these species is **High**, and the overall	The magnitude of effect and overall level of effect is considered the same as Baseline for the following bird species: • New Zealand pipit • Long-tailed cuckoo • North Island kākā • Australasian bittern • Spotless crake • Dabchick **Non-TAR birds** The magnitude of effect is assessed as **Negligible**, due to the local extent of effect and unlikely probability of disturbance due to noise, light and vibration from the areas of new road. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect is assessed as **Very Low** prior to mitigation.	**Non-TAR birds** The magnitude of effect is assessed as **Low** due to the local extent of effect and likely probability of loss in connectivity from the areas of new road. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **New Zealand pipit** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of these species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation.	The magnitude of effect and overall level of effect is considered the same as Baseline for the following bird species: • New Zealand pipit • Long-tailed cuckoo • North Island kākā • Australasian bittern • Spotless crake • Dabchick **Non-TAR birds** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required.

Effect Description	Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Long-tailed cuckoo** The magnitude of effect is assessed as **Negligible,** due to the local extent of effect and unlikely probability of disturbance due to noise, light and vibration from the areas of new road. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **North Island kākā** The magnitude of effect is assessed as **Negligible,** due to the local extent of effect and unlikely probability of disturbance due to noise, light and vibration from the areas of new road.	As such no impact management is required. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.	As such no impact management is required. **Long-tailed cuckoo** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **North Island kākā** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of this species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation.	Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.

Effect Description	Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	The ecological value of these species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **<u>Australasian bittern</u>** The magnitude of effect is assessed as **Negligible,** due to the local extent of effect and unlikely probability of disturbance due to noise, light and vibration from the areas of new road. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **<u>Spotless crake</u>** The magnitude of effect was adjusted to **Low** to ensure a mitigation control for spotless crake. This is because spotless crake may require specific management during		As such no impact management is required. **<u>Australasian bittern</u>** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **<u>Spotless crake</u>** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of this species is **High**, and the overall level of effect is assessed as **Low** prior to mitigation.	

Effect Description	Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	operation to prevent disturbance to nesting birds in the area. The ecological value of these species is **High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. **As such impact management is required.** **Dabchick** The magnitude of effect is assessed as **Low,** due to the local extent of effect and likely probability of disturbance due to noise, light and vibration from the areas of new road. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. **As such impact management is required**.		As such no impact management is required. **Dabchick** The magnitude of effect is assessed as **Negligible** due to the local extent of effect and unlikely probability of loss in connectivity from the areas of new road. The ecological value of this species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required.	
Impact management and residual	**Spotless crake**	Same as Baseline.	N/A	N/A

Effect Description	Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
level of effect	An Avifauna Management Plan for spotless crake should be developed to include consideration for: • Retention of vegetation near wetland habitat, where practicable. • Buffer planting between the road alignment and suitable habitat adjacent to the road (specifically wetlands WW8-W1 and WW8-W4. The residual impact is assessed as **Very Low** post mitigation. **Dabchick** An Avifauna Management Plan for dabchick should be developed to include consideration for: • Retention of vegetation near wetland habitat, where practicable. • Buffer planting between the road alignment and suitable habitat adjacent to the road (specifically wetland WW8-W1).			

Effect Description	Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	The residual impact is assessed as **Low** post mitigation.			
Management of residual effect	N/A	N/A	N/A	N/A

14.2.2.3Herpetofauna

Suitable habitat was identified within the NOR boundary which could potentially support herpetofauna. Native herpetofauna require vegetated corridors to facilitate natural dispersal, although they are considered to be relatively resident species and do not require migration or large-scale movement to support reproduction, refuge and feeding.

As the majority of NOR 8 will be new infrastructure, it is likely that there will be some localised lizard disturbance from noise, vibration and lighting and fragmentation of lizard habitat for a period during operation.

Table 14-8 outlines the operational effects assessment and impact management for herpetofauna.

Table 14-8 Assessment of ecological effects for herpetofauna and impact management during operation for NOR 8

Effect Description	Disturbance and displacement of existing and future herpetofauna due to light, noise, and vibration effects from the presence of the road		Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	**Copper skink, ornate skink** The magnitude of effect is assessed as **Low** due to the likely probability and relatively local extent of disturbance if the effect occurs. The ecological value of these species is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Low** prior to mitigation. As such no impact management is required. **Elegant gecko, forest gecko** The magnitude of effect is assessed as **Low** due to the likely probability and relatively local extent of disturbance if the effect occurs. The ecological value of these species is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Low** prior to mitigation.	**Copper skink, ornate skink** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and relatively local extent of disturbance if the effect occurs. The ecological value of these species is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Elegant gecko, forest gecko** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and relatively local extent of disturbance if the effect occurs. The ecological value of these species is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Very Low** prior to mitigation.	**Copper skink, ornate skink** The magnitude of effect is assessed as **Low** due to the likely probability and relatively local extent of loss in connectivity if the effect occurs. The ecological value of these species is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Low** prior to mitigation. As such no impact management is required. **Elegant gecko, forest gecko** The magnitude of effect is assessed as **Low** due to the likely probability and relatively local extent of loss in connectivity if the effect occurs. The ecological value of these species is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Low** prior to mitigation.	**Copper skink, ornate skink** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and relatively local extent of loss in connectivity if the effect occurs. The ecological value of these species is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Elegant gecko, forest gecko** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and relatively local extent of loss in connectivity if the effect occurs. The ecological value of these species is assessed to be **High**, and the overall level of effect due to the

Effect Description	Disturbance and displacement of existing and future herpetofauna due to light, noise, and vibration effects from the presence of the road		Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	As such no impact management is required. **Pacific gecko** The magnitude of effect is assessed as **Low** due to the likely probability and relatively local extent of disturbance if the effect occurs. The ecological value of this species is assessed to be **Moderate**, and the overall level of effect due to the presence of the road is assessed as **Low** prior to mitigation. As such no impact management is required.	As such no impact management is required. **Pacific gecko** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and relatively local extent of disturbance if the effect occurs. The ecological value of this species is assessed to be **Moderate**, and the overall level of effect due to the presence of the road is assessed as **Very Low** prior to mitigation. As such no impact management is required. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.	As such no impact management is required. **Pacific gecko** The magnitude of effect is assessed as **Low** due to the likely probability and relatively local extent of loss in connectivity if the effect occurs. The ecological value of this species is assessed to be **Moderate**, and the overall level of effect due to the presence of the road is assessed as **Low** prior to mitigation. As such no impact management is required.	presence of the road is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Pacific gecko** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and relatively local extent of loss in connectivity if the effect occurs. The ecological value of this species is assessed to be **Moderate**, and the overall level of effect due to the presence of the road is assessed as **Very Low** prior to mitigation. As such no impact management is required. Refer to Table 3-2 for the implications of Future Environment on Ecological Features for this NOR.
Impact management and residual	N/A	N/A	N/A	N/A

ATTACHMENT 65

ASSESSMENT OF ECOLOGICAL EFFECTS
PART 2 OF 5

Effect Description	Disturbance and displacement of existing and future herpetofauna due to light, noise, and vibration effects from the presence of the road		Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
level of effect				
Management of residual effect	N/A	N/A	N/A	N/A

14.2.3 Effects Conclusions

The ecological level of effects assessed as **Moderate** or higher for NOR 8 are described in Sections 14.2.3.1 and 14.2.3.2.

14.2.3.1Construction Effects

Long-tailed bats

- **Moderate** level of for disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics during construction for the Baseline and Likely Future Ecological Environment.

New Zealand pipit

- **High** level of effect for disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics during construction for the Baseline only.

The post mitigation level of effect is considered to be **Low** for construction related effects.

Spotless crake

- **Moderate** level of effect for disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics during construction for the Baseline and Likely Future Ecological Environment.

The post mitigation level of effect is considered to be **Very Low** for construction related effects.

Dabchick

- **Moderate** level of effect for disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics during construction for the Baseline and Likely Future Ecological Environment.

The post mitigation level of effect is considered to be **Very Low** for construction related effects.

14.2.3.2Operational Effects

Long-tailed bats

- **Very High** level of effect for the loss in connectivity due to the presence of the road resulting in changes to the population dynamics during operation for the Baseline. **High** level of effect for the Likely Future Ecological Environment.
- **Moderate** level of effect for disturbance and displacement to roosts and individuals of (new and existing) due to the presence of the infrastructure (noise, light, vibration etc) resulting in changes to the population dynamics during operation for the Baseline and Likely Future Ecological Environment.

The post mitigation level of effect is considered to be **Very Low** to **Low** for operational related effects.

Spotless crake

- **Moderate** level of effect for disturbance and displacement to nests and individuals of (new and existing) due to the presence of the infrastructure (noise, light, vibration etc) resulting in changes to the population dynamics during operation for the Baseline and Likely Future Ecological Environment.

The post mitigation level of effect is considered to be **Very Low** for operational related effects.

Dabchick

- **Moderate** level of effect for disturbance and displacement to nests and individuals of (new and existing) due to the presence of the infrastructure (noise, light, vibration etc) resulting in changes to the population dynamics during operation for the Baseline and Likely Future Ecological Environment.

The post mitigation level of effect is considered to be **Very Low** for operational related effects.

15 Warkworth Cumulative Effects

Upgrading existing roads and building new roads within a future urban environment with streams, wetlands, and open space conservation areas can have several cumulative ecological effects. Main potential effects include:

- **Native species disturbance**: Disturbance (through light, noise and vibration) associated with road construction and operation, along with similar effects associated with other activities in the vicinity, may have a cumulative effect on the native species. Although many of the native species observed are expected to use the Project Area and wider landscape and will habituate to noise light and vibration disturbance effects, long-tailed bats are more sensitive to disturbance and will require strategic mitigation as the future infrastructure develops.
- **Habitat fragmentation**: Roads can act as barriers to the movement of animals, including migratory species, leading to fragmentation of habitats. This can result in reduced genetic diversity, population declines, and changes to community structure.
- **Loss of habitat**: Road construction often involves clearing of vegetation, which can lead to the loss of habitat for native plant and animal species. This can lead to a decline in biodiversity and changes to ecosystem function.
- **Water quality impacts**: Roads can increase the amount of impervious surface in an area, leading to increased runoff and decreased infiltration of rainwater. This can result in increased erosion and sedimentation in nearby streams and wetlands, and the transport of pollutants from roads into aquatic ecosystems.
- **Changes in hydrology**: Roads can alter the natural flow of water in an area by changing the amount and timing of runoff, and by blocking or diverting water. This can lead to changes in the structure and function of streams and wetlands, as well as changes to the groundwater recharge rate.

To mitigate cumulative disturbance and connectivity effects, careful planning and design of roads and transportation infrastructure is important, such as incorporating measures such as green infrastructure, wildlife crossings, and vegetated buffers to protect sensitive habitats. Additionally, ongoing monitoring and adaptive management can help identify and address any unexpected impacts that may arise.

16 Design and Future Resource Consent Considerations

Ecological effects associated with activities that require regional consents and consideration under the NPS-FM are briefly discussed in the following sections to inform design and alignment options for the Project Area. Wildlife Act Authority permits are also discussed in relation to the potential killing or injuring of native fauna associated with the Project activities.

It is important to note that during the future detailed design process (as an additional consideration under the future regional consent process) there is scope within the designation to address (including to avoid) some potential effects/concerns/regional matters through design considerations at the detailed design phase.

16.1 Terrestrial Ecology

Construction of the Project will result in temporary and permanent loss of vegetation within the Project Area, including suitable habitat that is potentially being used by native fauna (long-tailed bats, avifauna, herpetofauna, and invertebrates).

As the design develops and resource consent applications are prepared, more detailed habitat and fauna surveys may be required to inform an EcIA (in line with the EIANZ Guidelines) which will be used to support future regional resource consent (for example, removal of vegetation in the riparian setback) and wildlife permit applications (if required).

The terrestrial vegetation to be lost (temporary and permanent) is comprised of both native and exotic vegetation which ranges in ecological value from Exotic Grassland (**Low** value) to Pūriri Forest (**High** value) (Section 5.2.1 and Appendix 6). Some of these areas are likely to provide habitat to native fauna, as discussed in Sections 16.1.1 to 16.1.4

This section includes detail of the terrestrial vegetation that is classified as SEA and occurs within the designation boundary of each NOR (Table 16-1). It is noted that the detailed design of the road and construction footprint will aim to avoid SEAs as far as practicable and therefore the approximate extent outlined in Table 16-1 is conservative (because it accounts for all SEA vegetation loss that occurs within the designation boundary).

Appendix 13 – Biodiversity Compensation Model (BCM) for potential SEA loss details the result of the Biodiversity Compensation Model (BCM) undertaken for each NOR potentially affected by SEA loss. The model results indicate a conservative offset extent of 2.04 ha (NOR 2), 0.34 ha (NOR 4) and 3.05 ha (NOR 5). For each potentially affected NOR, degraded habitat adjacent to existing SEAs and within the designation boundary provide restoration potential. NORs not affected by potential SEA loss provide further offset potential where degraded habitats within the designation boundaries are in proximity to an existing SEA (for example NOR 8 and SEA_T_2367) or near higher value features (for example stream and wetlands associated with NOR 3 and NOR 6). Overall, based on these initial estimates, it is expected that the potential (maximum) loss of SEAs can be compensated for within the existing designation boundary. It is expected that further detailed offset modelling (using BOAM or similar) will be used during the regional consenting phase of work and will be based upon more detailed site investigations of impacted SEAs and potential offset locations.

Table 16-1 Potential area of SEA loss within the designation boundary

Feature	Classification*	Footprint (m^2)		
		NOR 2	NOR 4	NOR 5
SEA_T_5440	WF7.1			1,264
SEA_T_6684	MF4			579
SEA_T_6684	EF			1,934
SEA_T_5440	TL3		774	
SEA_T_6676	TL3	1,287		
SEA_T_6676	WF11	1,147		

Notes: * = Classification as per Singers et al. (2017).

16.1.1 Long-tailed bats

Mature vegetation in suitable habitat areas (as identified in each NOR section) may provide potential habitat for bat roosts and facilitate bat movement in the broader landscape. The presence of bats and roosts will be re-assessed prior to obtaining any Regional resource consents for vegetation removal (relevant under regional matters) and to support an application for a wildlife permit. The loss of some of this habitat is already assessed because they are district plan trees.

The presence of bat habitat and bat roosts will require a BMP. The objectives of bat management will be to:

- Identify bat priority areas that may be affected by the Project.
- Avoid bat priority areas through alignment and design.
- Avoid effects of lighting and noise on bats within bat priority areas.
- Avoid injury and/or death of roosting bats during vegetation removal.
- Avoid disturbance through construction management (seasonal restriction on vegetation removal December to April)
- Outline additional mitigation where avoidance is not feasible including any offset/compensation that may be required.

16.1.2 Avifauna

Native avifauna as identified in Section 5.2.3 have the potential to be present within the Project Area. The habitats that native avifauna may utilise are detailed in each NOR section. Vegetation clearance required for construction could result in the loss of these habitats and any vegetation clearance within the bird nesting season (September – February) will need to be managed in accordance with the Wildlife Act 1953. The loss of some of this habitat is already assessed because they are district plan trees.

Additionally, species not identified in Section 5.2.3 such as Northern New Zealand dotterel have the potential to nest in construction sites (due to habitat preference). Therefore, impacts (including disturbance) will need to be managed during construction.

16.1.3 Herpetofauna

Native herpetofauna as identified in Section 5.2.4 have the potential to be present within vegetation impacted by the Project. Therefore, there is potential that site clearance required for construction could kill or injure native herpetofauna species and result in the removal of their habitat. Any vegetation clearance where native herpetofauna are likely to occur will also need to be managed in accordance with the Wildlife Act 1953.

16.1.4 Invertebrates

Kauri snail (*Paryphanta* spp.), flax snails (*Placostylus* spp.), large land snails (*Powelliphanta* spp.), and Auckland tree wētā (*Hemideina thoracica*) are potentially present in in NOR 2 (Woodcocks Road Upgrade), NOR 4 (Matakana Road Upgrade), and NOR 7 (Sandspit Link). Impact management will be required under the Wildlife Act to prevent killing or injuring these species. As part of this management pre-clearance inspections should be undertaken prior to vegetation removal.

16.2 Freshwater Ecology

The construction of the Project will directly impact 20 streams, ranging from **Low** to **High** ecological value. Approximately 868 m of stream reclamation will be required to accommodate the Project works. The predicted permanent and intermittent stream loss for the Project is presented in Table 16-2. These calculations will require re-evaluation (including a Stream Ecological Valuation) as part of the future regional consent process. All assessed streams have been modified and degraded to varying degrees and there is an opportunity to restore riparian habitat along these features

During the detailed design phase, stream crossing plans (i.e., bridge or culvert) will be confirmed as well as details regarding fish passage requirements. Under a future regional and NPS-FM consent for instream works, earthworks and vegetation removal, impact management would also be required for fish salvage and relocation, sediment control and management of the riparian condition.

Table 16-2 Potential stream loss (permanent and intermittent) within the Project Area

Stream ID	Hydroperiod	Ecological Value	Length to be lost (m)*	Relevant NOR
WW2-S4	Intermittent	Low	20	NOR 2
WW3-S2a	Permanent	Moderate	14	NOR 3
WW3-S2b	Permanent	Moderate	29	NOR 3
WW3-S3a	Permanent	Moderate	4	NOR 3
WW3-S3b	Permanent	Moderate	8	NOR 3
WW3-S4a	Permanent	Moderate	11	NOR 3
WW3-S4b	Permanent	Moderate	140	NOR 3
WW4-S1	Intermittent	Low	21	NOR 4
WW4-S2	Intermittent	Low	27	NOR 4
WW4-S3	Intermittent	Low	28	NOR 4
WW5-S1	Permanent	High	10	NOR 5
WW5-S3	Intermittent	Low	43 (NOR 5), 104 (NOR 7)	NOR 5, NOR 7
WW5-S4	Intermittent	Low	18	NOR 5
WW5-S5	Intermittent	Low	17	NOR 5
WW5-S6	Intermittent	Low	17	NOR 5
WW7-S2b	Intermittent	Low	70	NOR 7
WW7-S3a	Permanent	Moderate	31	NOR 7
WW7-S5	Intermittent	Low	45	NOR 7

Stream ID	Hydroperiod	Ecological Value	Length to be lost (m)*	Relevant NOR
WW8-S1	Intermittent	Moderate	122	NOR 8
WW8-S2	Intermittent	Moderate	89	NOR 8

Notes: * = Some assessments were carried out at a desktop level, making it difficult to accurately delineate stream width and length. Therefore, lengths are indicative.

16.3 Wetland Ecology

Wetland extent and approximate value was considered during the Multi Criteria Assessment (MCA) to inform the Alternatives Assessment for all of the proposed alignment options. This was achieved through a desktop wetland delineation for all of the NOR options along with a proxy-based assessment of ecological value (catchment condition, vegetation cover, relationship with other ecological features).

The construction of the Project will impact 17 natural inland wetlands, and one artificial wetland ranging from **Low** to **Moderate** ecological value. Approximately 14,863 m^2 of direct wetland loss will occur (Table 16-3). These calculations will require re-evaluation (including comprehensive wetland delineation and ecological valuation) as part of the future regional consent process. All assessed wetlands have been modified and degraded to varying degrees and there is an opportunity to restore riparian habitat along these features

During the detailed design phase, wetland crossing plans (i.e., bridge or culvert) will be confirmed as well as details regarding fish passage requirements. Under a future regional and NPS-FM consent for wetland works, earthworks and vegetation removal or discharge impact management would also be required for fish salvage and relocation, sediment control and management of the riparian condition.

Table 16-3 Potential wetland loss within the Project Area

Wetland ID	Vegetation Type	Ecological Value	Loss (m^2)	Relevant NOR
WW2-W2	Exotic Wetland (EW)	Low	57	NOR 2
WW3-W3	Exotic Wetland (EW)	Moderate	908	NOR 3
WW3-W4	Exotic Wetland (EW)	Moderate	180	NOR 3
WW3-W5	Exotic Wetland (EW)	Low	476	NOR 3
WW4-W1	Exotic Wetland (EW)	Moderate	130	NOR 4
WW4-W2	Exotic Wetland (EW)	Moderate	124	NOR 4
WW4-W3	Exotic Wetland (EW)	Low	603	NOR 4
WW5-W1	Exotic Wetland (EW)	Low	195	NOR 5
WW5-W3	Exotic Wetland (EW)	Low	130	NOR 5
WW6-O2^	Open Water (OW)	Low	225	NOR 6

Wetland ID	Vegetation Type	Ecological Value	Loss (m^2)	Relevant NOR
WW7-W3	Exotic Wetland (EW)	Moderate	2,422	NOR 7
WW7-W4	Exotic Wetland (EW)	Low	56	NOR 7
WW7-W5	Exotic Wetland (EW)	Low	610	NOR 7
WW7-W6	Exotic Wetland (EW)	Low	83	NOR 7
WW7-W7	Exotic Wetland (EW)	Low	143	NOR 7
WW8-W1	Planted Wetland (PLW)	Moderate	4,622	NOR 8
WW8-W2	Exotic Wetland (EW)	Low	148	NOR 8
WW8-W4	Exotic Wetland (EW)	Moderate	3,751	NOR 8

Notes: * = Some assessments were carried out at a desktop level, therefore areas are indicative. ^ = Artificial wetland.

17 Conclusion

Construction Effects

Table 17-1 to Table 17-3Table 17-3 provides a summary of district matter ecological effects during construction prior to any mitigation. The summary represents the level of effect for the baseline and the likely future ecological environment as one where they are the same and with a * where they differ. Where the level of effect was assessed to be **Moderate** or higher, then mitigation has been developed.

Construction effect mitigation measures will include:

- A Bat Management Plan (BMP) for NOR 2, NOR 4, NOR 5, NOR 7, and NOR 8 should be developed to include consideration for:
  - Surveys prior to construction to confirm presence/likely absence. Surveys to confirm bat roost locations if activity is confirmed.
  - Confirmation of maternity roosts may require a seasonal restriction on construction activity (no or restricted construction during Dec-Mar).
  - Siting of compounds and laydown areas to avoid bat habitat.
  - Lighting design to reduce light levels and spill from construction areas.
  - Restriction of nightworks around bat habitat.
  - Bat management should be incorporated with any regional consent conditions (i.e., BMPs) that may be required for regional compliance.
- An Avifauna Management Plan (AMP) for all NORs should be developed to include consideration for:
  - New Zealand pipit (all NORs)
    - Pre-construction nesting bird surveys in suitable habitat (EG, ES).
    - Timing consideration for construction works (avoiding breeding season, where practicable).
    - Methods to minimise disturbance if the breeding season cannot be avoided.
  - Spotless crake (all NORs excluding NOR 2)
    - Pre-construction nesting bird surveys at specific wetland habitat.
    - Timing consideration for construction works (avoiding breeding season, where practicable).
    - Methods to protect and buffer nesting birds (if present).
  - Dabchick (NOR 8)
    - Pre-construction nesting bird surveys at wetland WW8-W1.
    - Timing consideration for construction works (avoiding breeding season, where practicable).
    - Methods to protect and buffer nesting birds (if present).

Table 17-1 Summary of ecological effects during construction prior to mitigation for long-tailed bats

Construction – Long-tailed bats	
NOR	**Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust, vibration etc.)**
NOR 1	Low
NOR 2	**Moderate**

Construction – Long-tailed bats	
NOR 3	Low
NOR 4	**Moderate**
NOR 5	**Moderate**
NOR 6	Low
NOR 7	**Moderate**
NOR 8	**Moderate**

Notes: * = Indicates a level of effect associated with the Likely Future Ecological Environment that is different from the baseline level of effects.

Table 17-2 Summary of ecological effects during construction prior to mitigation for avifauna

	Construction – Avifauna
NOR	**Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc.)**
NOR 1	
Non-TAR birds	Very Low
New Zealand pipit	**High** *Very Low
Australasian bittern	Low
Spotless crake	**Moderate**
NOR 2	
Non-TAR birds	Very Low
New Zealand pipit	**High** *Very Low
North Island kākā	Very Low
Long-tailed cuckoo	Low
Black shag, little black shag, little shag, pied shag	Very Low
NOR 3	
Non-TAR birds	Very Low
New Zealand pipit	**High** *Very Low

	Construction – Avifauna
Australasian bittern	Low
Spotless crake	**Moderate**
NOR 4	
Non-TAR birds	Very Low
New Zealand pipit	**High** *Very Low
North Island kākā	Very Low
Long-tailed cuckoo	Low
Australasian bittern	Low
Spotless crake	**Moderate**
NOR 5	
Non-TAR birds	Very Low
New Zealand pipit	**High** *Very Low
North Island kākā	Very Low
Long-tailed cuckoo	Low
Australasian bittern	Low
Spotless crake	**Moderate**
NOR 6	
Non-TAR birds	Very Low
New Zealand pipit	**High** *Very Low
Australasian bittern	Low
Spotless crake	**Moderate**
NOR 7	
Non-TAR birds	Very Low
New Zealand pipit	**High** *Very Low
North Island kākā	Very Low
Long-tailed cuckoo	Low

	Construction – Avifauna
Black shag, little black shag, little shag, pied shag	Very Low
Australasian bittern	Low
Spotless crake	**Moderate**
NOR 8	
Non-TAR birds	Very Low
New Zealand pipit	**High** *Very Low
North Island kākā	Very Low
Long-tailed cuckoo	Low
Australasian bittern	Low
Spotless crake	**Moderate**
Dabchick	**Moderate**

Notes: * = Indicates a level of effect associated with the Likely Future Ecological Environment that is different from the baseline level of effects.

Table 17-3 Summary of ecological effects during construction prior to mitigation for herpetofauna

	Construction – Herpetofauna
NOR	**Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc.)**
NOR 1	
Copper skink	Low *Very Low
NOR 2	
Copper skink, ornate skink	Very Low
Elegant gecko, forest gecko	Low *Very Low
Pacific gecko	Low *Very Low
NOR 3	
Copper skink	Very Low

	Construction – Herpetofauna
NOR 4	
Copper skink, ornate skink	Very Low
Elegant gecko, forest gecko	Low *Very Low
Pacific gecko	Low *Very Low
Hochstetter's frog	Very Low
NOR 5	
Copper skink, ornate skink	Very Low
Elegant gecko, forest gecko	Low *Very Low
Pacific gecko	Low *Very Low
Hochstetter's frog	Low
NOR 6	
Copper skink	Very Low
NOR 7	
Copper skink, ornate skink	Low *Very Low
Elegant gecko, forest gecko	Low *Very Low
Pacific gecko	Low *Very Low
Hochstetter's frog	Low *Very Low
NOR 8	
Copper skink, ornate skink	Low *Very Low
Elegant gecko, forest gecko	Low *Very Low

	Construction – Herpetofauna
Pacific gecko	Low *Very Low

Notes: * = Indicates a level of effect associated with the Likely Future Ecological Environment that is different from the baseline level of effects.

The residual (post-mitigation) level of effect for all construction effects are considered **Negligible** to **Low**.

Operational Effects

Table 17-4 to Table 17-6 provides a summary of district matter ecological effects during operation prior to any mitigation. The summary represents the level of effect for the baseline and the likely future ecological environment as one where they are the same and with a * where they differ. Where the level of effect was assessed to be **Moderate** or higher, then mitigation has been developed.

Operational effect mitigation measures will include:

- A Bat Management Plan (BMP) for NOR 2, NOR 3, NOR 4, NOR 5, NOR 7, and NOR 8 should be developed to include consideration for:
  - Indicative early-stage/mature buffer planting, late-stage buffer planting, and retention of existing mature trees between the road alignment and features with potential for bat roosts as outlined in the indicative bat mitigation in Appendix 12 – Indicative Mitigation Areas.
  - Light and noise management through design.
  - Future presence of roosts within the alignment (placement of flaps on features with high roost potential).
  - Assumptions in the efficacy of the proposed mitigation will be addressed through an adaptive management framework that will outline bat activity thresholds, robust monitoring, and potential corrective action.
- An Avifauna Management Plan (AMP) for all NORs should be developed to include consideration for:
  - Spotless crake (all NORs excluding NOR 2)
    - Retention of vegetation near wetland habitat, where practicable.
    - Buffer planting between the road alignment and suitable habitat adjacent to the road.
  - Dabchick (NOR 8)
    - Retention of vegetation near wetland habitat, where practicable.
    - Buffer planting between the road alignment and suitable habitat adjacent to the road.

Table 17-4 Summary of ecological effects during operation prior to mitigation for long-tailed bats

Operation – Long-tailed bats		
NOR	**Disturbance and displacement of (new and existing) roosts and individuals due to the presence of the road (noise, vibration, light etc.)**	**Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape**

Operation – Long-tailed bats		
NOR 1	Low	Low
NOR 2	**Moderate**	**High**
NOR 3	Very Low	**Moderate**
NOR 4	Low	**Moderate**
NOR 5	Low	**Moderate**
NOR 6	Low	Low
NOR 7	**Moderate**	**Moderate**
NOR 8	**Moderate**	**Very High** ***High**

Notes: * = Indicates a level of effect associated with the Likely Future Ecological Environment that is different from the baseline level of effects.

Table 17-5 Summary of ecological effects during operation prior to mitigation for avifauna

Operation – Avifauna		
NOR	**Disturbance and displacement to nests and individual birds (existing) due to the presence of the road (noise, light, dust etc.)**	**Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure**
NOR 1		
Non-TAR birds	Very Low	Very Low
New Zealand pipit	Very Low	Very Low
Australasian bittern	Low	Low
Spotless crake	**Moderate**	Very Low
NOR 2		
Non-TAR birds	Very Low	Very Low
New Zealand pipit	Very Low	Very Low
North Island kākā	Very Low	Very Low
Long-tailed cuckoo	Low	Low
Black shag, little black shag, little shag, pied shag	Very Low	Very Low
NOR 3		

Operation – Avifauna		
Non-TAR birds	Very Low	Very Low
New Zealand pipit	Very Low	Very Low
Australasian bittern	Low	Low
Spotless crake	**Moderate**	Very Low
NOR 4		
Non-TAR birds	Very Low	Very Low
New Zealand pipit	Very Low	Very Low
North Island kākā	Very Low	Very Low
Long-tailed cuckoo	Low	Low
Australasian bittern	Low	Low
Spotless crake	**Moderate**	Very Low
NOR 5		
Non-TAR birds	Very Low	Very Low
New Zealand pipit	Very Low	Very Low
North Island kākā	Very Low	Very Low
Long-tailed cuckoo	Low	Low
Australasian bittern	Low	Low
Spotless crake	**Moderate**	Very Low
NOR 6		
Non-TAR birds	Low *Very Low	Very Low
New Zealand pipit	Low *Very Low	Very Low
Australasian bittern	Low	Low
Spotless crake	**Moderate**	Very Low
NOR 7		
Non-TAR birds	Low *Very Low	Low *Very Low
New Zealand pipit	Very Low	Very Low

Operation – Avifauna		
North Island kākā	Very Low	Very Low
Long-tailed cuckoo	Low	Low
Black shag, little black shag, little shag, pied shag	Very Low	Very Low
Australasian bittern	Low	Low
Spotless crake	**Moderate**	Very Low
NOR 8		
Non-TAR birds	Low *Very Low	Very Low
New Zealand pipit	Very Low	Very Low
North Island kākā	Very Low	Very Low
Long-tailed cuckoo	Low	Low
Australasian bittern	Low	Low
Spotless crake	**Moderate**	Low
Dabchick	**Moderate**	Low

Notes: * = Indicates a level of effect associated with the Likely Future Ecological Environment that is different from the baseline level of effects.

Table 17-6 Summary of ecological effects during operation prior to mitigation for herpetofauna

Operation – Herpetofauna		
NOR	**Disturbance and displacement of existing and future herpetofauna due to the presence of the road (noise, vibration, light etc.)**	**Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure**
NOR 1		
Copper skink	Very Low	Very Low
NOR 2		
Copper skink, ornate skink	Very Low	Very Low
Elegant gecko, forest gecko	Low *Very Low	Very Low

Operation – Herpetofauna		
Pacific gecko	Low *Very Low	Very Low
NOR 3		
Copper skink	Very Low	Very Low
NOR 4		
Copper skink, ornate skink	Very Low	Very Low
Elegant gecko, forest gecko	Very Low	Very Low
Pacific gecko	Very Low	Very Low
Hochstetter's frog	Very Low	Very Low
NOR 5		
Copper skink, ornate skink	Very Low	Very Low
Elegant gecko, forest gecko	Very Low	Very Low
Pacific gecko	Very Low	Very Low
Hochstetter's frog	Very Low	Low *Very Low
NOR 6		
Copper skink	Very Low	Very Low
NOR 7		
Copper skink, ornate skink	Low *Very Low	Low *Very Low
Elegant gecko, forest gecko	Low *Very Low	Low
Pacific gecko	Low *Very Low	Low
Hochstetter's frog	Low *Very Low	Low
NOR 8		

Operation – Herpetofauna		
Copper skink, ornate skink	Low *Very Low	Low *Very Low
Elegant gecko, forest gecko	Low *Very Low	Low *Very Low
Pacific gecko	Low *Very Low	Low *Very Low

Notes: * = Indicates a level of effect associated with the Likely Future Ecological Environment that is different from the baseline level of effects.

The residual (post-mitigation) level of effect for all operational effects are considered **Negligible** to **Low**.

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1 Appendix 1 – Ecological Impact Assessment Methodology

The standard by which this EcIA was undertaken follows the guidelines published by the Environment Institute of Australia and New Zealand (EIANZ Guidelines) (Roper-Lindsay et al., 2018).

1.1 Assessment of Ecological Value

The first step in the EcIA approach is to assess the value of ecological features in terms of Representativeness, Rarity, Diversity and Pattern, and Ecological context. Details on each matter and its associated considerations are provided in Table 18-1 for terrestrial ecological value and Table 18-2 aquatic ecological value

Table 18-1 Matters and considerations for the assessment of terrestrial ecological value

Representativeness
Typical structure and composition
Indigenous representation
Rarity/distinctiveness
Species of conservation significance
Range restricted or endemic species
Distinctive ecological values
Diversity and pattern
Habitat diversity
Species diversity
Patterns in habitat use
Ecological context
Size, shape and buffering
Sensitivity to change
Ecological networks (linkages, pathways, migration)

Table 18-2 Matters and considerations for the assessment of aquatic ecological value

Representativeness (including SEV, RHA and ecological integrity)
Extent to which site/catchment is typical of characteristic
Instream habitat modification

Representativeness (including SEV, RHA and ecological integrity)
Riparian habitat modification
Hydrological modification
Catchment conditions
Geomorphological modification
Water quality modification
Presence of alien and invasive species
Invertebrate assemblage representation
Fish assemblage representation
Rarity/descriptiveness
Pool characterisation
Species of conservation significance
Range restricted or endemic species
Stream type (rare or distinctive)
Diversity and pattern
Distinctive ecological values
Level of natural diversity
Diversity metrics
Complexity of community
Ecological context (Ecosystem services, importance sensitivity)
Stream order
Catchment size
Hydroperiod
Sensitivity to flow modification
Sensitivity water quality modification
Sensitivity to sedimentation/erosion
Connectivity and migration

1.2 Assessment of Ecological Effects

The ecological effects assessment includes several steps that collectively assess the way the Project will interact with elements of the physical and biological, environment to produce effects to habitat and receptors. The method for determining the level of effect is outlined in the following sections.

Basic impact characteristic terminology and respective descriptors are incline with the EIANZ Guidelines and are provided in Table 18-3.

Table 18-3 Magnitude of effect assessment terminology

Characteristic	Definition	Designations
Type	A descriptor indicating the relationship of the impact to the Project (in terms of cause and effect)	Direct
		Indirect
Extent	The "reach" of the impact (e.g., confined to a small area around the Project Footprint, projected for several kilometres, etc.)	Local
		Regional
		National
Duration	The time period over which a resource/receptor is affected	Temporary (days or months)
		Short-term (<5 years)
		Long-term (15-25 years)
		Permanent (>25 years)
Frequency	A measure of the constancy or periodicity the receptor will be affected	Infrequently
		Periodically
		Frequently
		Continuously
Likelihood	The probability of an effect occurring if it is unplanned	Highly Unlikely
		Unlikely
		Likely
		Highly Likely
		Definite
Reversibility	The degree to which the ecological effect can be reversed in a reasonable time scale through natural processes or mitigation	Totally
		Partially
		Irreversible
		Not applicable

Based on the above-mentioned descriptors, the characteristics of each effect are used to assign a magnitude to the specific effect. Magnitude designations are provided in Table 18-4.

Table 18-4 Magnitude of effect descriptions

Magnitude	Description
Very High	Total loss of, or very major alteration to, key elements/features of the existing baseline conditions, such that the post-development character, composition and or attributes will be fundamentally changes and may be lost from the site altogether; and/or loss of very high proportion of the known population or range of the elements/features
High	Major loss or major alteration to key elements/features of the existing baseline such that the post-development character, composition and/or attributes will be fundamentally changed; and/or loss of a high proportion of the known population or range of the element/feature
Moderate	Loss or alteration to one or more key elements/features of the existing baseline such that the post-development character, composition and/or attributes will be partially changed; and/or loss of a moderate proportion of the known population or range of the element/feature
Low	Minor shift away from the existing baseline conditions. Change arising from the loss/alteration will be discernible, but underlying character, composition and/or attributes of the existing baseline conditions will be similar or pre-development circumstances or patterns; and or having a minor effect on the known population or range of the element/feature
Negligible	Very slight change from the existing baseline condition. Change barely distinguishable, approximating to the 'no change' situation; and/or having negligible effect on the known population or range of the element/feature

The magnitude of an effect is considered in relation to the ecological value of the habitat or receptor to be impacted on. The ecological value of habitat or receptors are the primary focus of the ecological assessment. The ecological value of habitat or receptors are typically expressed on a local, district, regional or national scale. The ecological value designations are provided in Table 18-5.

Table 18-5 Ecological value descriptions

Value	Description
Very high	Area rates High for three or all the four assessment matters. Likely to be of National importance and recognised as such
High	Area rates High for two of the assessment matters, Moderate and Low for the remainder or Area rates High for 1 so the assessment matters, moderate for the remainder. Likely to be regionally important and recognised as such
Moderate	Area rates High for one matter, Moderate and Low Dortha remainder, or Area rates Moderate for 2 or more assessment matters Low or Very low for the remainder. Likely to be important at the level of the Ecological District
Low	Area rates Low or Very low for most assessment matters and Moderate for one. Limited ecological value other as local habitat for tolerant species
Negligible	Area rates Very low for three matters and Moderate, Low or Very low for the remainder

Once magnitude of effect and the ecological value of the habitat or receptor have been determined, the level of effect can be assigned for each effect using the matrix shown in Table 18-6.

Table 18-6 Ecological effect matrix

		Ecological Values				
		Very High	High	Moderate	Low	Negligible
Magnitude	Very High	Very High	Very High	High	Moderate	Low
	High	Very High	Very High	Moderate	Low	Very Low
	Moderate	High	High	Moderate	Low	Very Low
	Low	Moderate	Low	Low	Very Low	Very Low
	Negligible	Low	Very Low	Very Low	Very Low	Very Low
	Positive	Negligible	Negligible	Negligible	Negligible	Negligible

From Table 18-6, the level of effect designations are defined below:

- **Negligible**: An effect of negligible consequence is one where habitat or receptors will not be affected in any meaningful way by a Project activity, or the predicted effect is indistinguishable from natural background variations;
- **Low**: An effect of minor consequence is one where habitat or receptors will experience a noticeable effect, but the effect magnitude is sufficiently small (with or without mitigation) and/or the resource/receptor is of low ecological value. In either case, the magnitude should be well within applicable standards;
- **Moderate**: An effect of moderate consequence has an effect magnitude that is within applicable standards but higher than that of a minor effect. The emphasis for moderate effects is to show that the effect has been reduced or minimised in line with the mitigation hierarchy;
- **High**: A high level of effect of is one where an accepted limit or standard may be exceeded, or moderate magnitude of effect will occur to moderate or high value habitat or receptors;
- **Very High**: A very high level of effect will occur when the magnitude and value of effects are assessed as high or very high. Typically, very high level of effects notably exceeds standard limits.

1.3 Impact Management

Informed by the level of effects suitable impact management measures are provided consistent with the mitigation hierarchy. The priority in mitigation is to first apply mitigation measures to the source of the impact (avoid) and then to address the resultant effects (reduce or minimise) of the impact.

1.4 Residual Impacts

Once mitigation measures are declared, the next step in the effect assessment process was to assign residual impact significance. This is a repeat of the impact assessment steps discussed above, considering the assumed implementation of the additional recommended mitigation measures.

1.5 Managing Uncertainty

Biophysical impacts are difficult to predict with certainty, but uncertainty stemming from on-going development of the Project design and implementation is inevitable, and the environment is variable over time. If uncertainties are relevant to the effect assessment, they were stated and approached conservatively, to identify a range of likely residual effects and relevant mitigation measures.

1.6 Cumulative Effects

Cumulative impacts and effects are those that arise because of an impact and effect from the Project interacting with those from another activity to create an additional impact and effect. These are termed cumulative impacts and effects. No structed methods were employed to assess cumulative impacts, but where relevant descriptions of potential cumulative effects have been provided.

2 Appendix 2 – Auckland Unitary Plan Activities

Auckland Unitary Plan – E26 Infrastructure

Table E26.4.3.1 below is relevant for considering effects and recommending mitigation in relation to tree removal. Note that, except for Trees in Roads, in Open Space Zones and Notable Trees, trees are not protected under the AUP.

Table E26.4.3.1 Activity table - Network utilities and electricity generation – Trees in roads and open space zones and the Notable Trees Overlay

Activity	Activity Status			Permitted Standards or Matters of Discretion / Control
	Trees in roads [dp]	Open space zones [dp]	Notable trees [dp]	
(A89) Tree removal of Notable Trees	N/A	N/A	Discretionary	N/A
(A90) Tree trimming, alteration or removal on roads adjoining rural zones and on roads adjoining the Future Urban Zone	Permitted	N/A	N/A	N/A
(A91) Tree alteration or removal of any tree less than 4m in height and/or less than 400mm in girth	Permitted	Permitted	Restricted Discretionary	N/A
(A92) Tree alteration or removal of any tree greater than 4m in height and/or greater than 400mm in girth	Restricted Discretionary	Restricted Discretionary	N/A	N/A
(A93) Tree trimming, alteration and removal not otherwise provided for	D	D	D	N/A

Auckland Unitary Plan – E26 Infrastructure

The table below is relevant for considering effects and recommending mitigation in relation to vegetation clearance. Also refer to Table E15.4.1.

Table E26.3.3.1 Activity table – Network utilities and electricity generation and vegetation management

Activity	Activity Status						Permitted Standards
	Rural zones, coastal areas and riparian areas [rp]	SEA [rp]	ONF [dp]	HNC [dp]	ONL [dp]	ONC [dp]	
(A76) Vegetation alteration or removal	P	P	P	P	P	P	Refer to E26.3.5.4. Vegetation alteration or removal for Permitted Activity Standards
(A77) Vegetation alteration or removal that does not comply with Standards E26.3.5.1 to E26.3.5.4	RD	RD	RD	RD	RD	RD	
(A78) Vegetation alteration or removal not otherwise provided for	D	D	D	D	D	D	

Note: Greyed-out boxes relate to Regional Activities which are not considered as part of the NOR and will be relevant for future Regional Resource Consents.

Auckland Unitary Plan – E15 Vegetation management and biodiversity

Table E15.4.1 below is relevant for considering effects of activities over and above those that are permitted and recommending mitigation in relation to vegetation clearance in urban and FUZ zones, and adjacent to riparian areas.

Table E15.4.1 Activity table - Auckland-wide vegetation and biodiversity management rules

Activity	Activity Status	Permitted Standards
Riparian areas (as described below)		
(A16) Vegetation alteration or removal within 20m of rural streams, other than those in Rural – Rural Production Zone and Rural – Mixed Rural Zone	RD	N/A
(A17) Vegetation alteration or removal within 10m of rural streams in the Rural – Rural Production Zone and Rural – Mixed Rural Zone	RD	N/A

Activity	Activity Status	Permitted Standards
(A18) Vegetation alteration or removal within 20m of a natural inland wetland, in the bed of a river or stream (permanent or intermittent), or lake	RD	N/A
(A19) Vegetation alteration or removal within 10m of urban streams	RD	N/A
All other zones and areas not covered above (i.e. Urban Zones and FUZ)		
(A22A) Vegetation alteration or removal	P	Refer to E15.6. Vegetation alteration or removal for Permitted Activity Standards
All areas		
(A23) Permitted activities in Table E15.4.1 that do not comply with one or more of the standards in E15.6	RD	N/A

Auckland Unitary Plan – E26 Infrastructure - Earthworks

The table below is relevant for considering effects of activities over and above those that are permitted and recommending mitigation in relation to earthworks.

Table E26.5.3.1 Activity table - Earthworks all zones and roads [dp]

Activity	Activity Status	Permitted Standards
(A95) Earthworks up to 2500m2 other than for maintenance, repair, renewal, minor infrastructure upgrading	P	Refer to E26.5.5.2. General standards (District)
(A96) Earthworks up to 2500m3 other than for maintenance, repair, renewal, minor infrastructure upgrading	P	Refer to E26.5.5.2. General standards (District)
(A97) Earthworks greater than 2500m2 other than for maintenance, repair, renewal, minor infrastructure upgrading	RD	N/A
(A97A) Earthworks greater than 2500m3 other than for maintenance, repair, renewal, minor infrastructure upgrading	RD	N/A

3 Appendix 3 – Regional Plan, District Plan and Wildlife Act Matters

Table 18-7 Ecological effects of road infrastructure construction broken down into AUP:OP Regional and District Plan matters, and Wildlife Act (1953)

Ecological feature	Activity	Ecological Effect	AUP:OP District Plan provisions	AUP:OP Regional Plan provisions	Wildlife Act (1953)
Construction					
Terrestrial habitat	Vegetation removal (including trees) outside of roads and public spaces in: a) a rural zone b) riparian margins c) coastal areas d) SEAs This also includes other terrestrial habitat of value identified in the EcIA.	Permanent loss of habitat/ecosystem, fragmentation and edge effects.		✓	
	Vegetation removal (including trees) in: a) Roads b) Public spaces c) ONFs d) ONLs e) HNCs f) ONCs	Permanent loss of habitat/ecosystem, fragmentation and edge effects.	✓		
	Earthworks – leading to invasion of bare earth surfaces with weeds and transfer of weeds (seeds and fragments) between earthworks areas.	Weed dispersal to previously unaffected areas of indigenous vegetation, reduction in terrestrial biodiversity.		✓	
Bats	Vegetation removal.	Roost loss.		✓	✓
	Vegetation removal.	Kill or injure individual.			✓
	Vegetation removal.	Loss of foraging habitat.		✓	
	Construction activities (Noise, light, dust etc.).	Disturbance and displacement to roosts and to individuals (existing).	✓		✓
Birds (native)	Vegetation removal.	Nest loss.		✓	✓
	Vegetation removal.	Kill or injure individual.			✓
	Vegetation removal.	Loss of foraging habitat.		✓	

Ecological feature	Activity	Ecological Effect	AUP:OP District Plan provisions	AUP:OP Regional Plan provisions	Wildlife Act (1953)
	Construction activities (noise, light, dust etc).	Disturbance and displacement of roosts and individuals (existing).	✓		✓
Herpetofauna (native)	Vegetation removal.	Lizard habitat loss		✓	
	Vegetation removal.	Kill or injure individual			✓
	Construction activities (noise, light, dust etc).	Disturbance and displacement of individuals (existing).	✓		✓
	Reclamation/culvertin g/other structures e.g., bank armouring.	Permanent loss/modification of habitat/ecosystem.		✓	
Freshwater habitat – wetland or stream (including riparian margins)	Vegetation removal.	Permanent loss of habitat/ecosystem, fragmentation and edge effects.		✓	
	Construction activities – earthworks (leading to sediment discharge), machinery use and chemical storage (leading to leaks/spills).	Uncontrolled discharge leading to habitat and water quality degradation.		✓	
	Diversion, abstraction or bunding of watercourses and water level/flow/ periodicity changes.	Detrimental effects on habitats including plant composition and fauna.		✓	
Fish (native)	Reclamation/diversion /other structures e.g., bank armouring.	Loss of aquatic habitat.		✓	
	Reclamation/diversion /culverting/other structures e.g., bank armouring.	Kill or injure individual.			✓
Operation					
Terrestrial habitat	Presence of the road - use of road edges as dispersal corridors by invasive plant species.	Weed dispersal to previously unaffected areas of indigenous vegetation, reduction in terrestrial biodiversity.		✓	
	Road maintenance - increased use of herbicides.	Increased weed incursion, unintentional spray of indigenous vegetation.		✓	
Bats	Vehicle movement.	Kill or injure individual.			✓

Ecological feature	Activity	Ecological Effect	AUP:OP District Plan provisions	AUP:OP Regional Plan provisions	Wildlife Act (1953)
	Presence of the road.	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat.	✓		✓
	Lighting and noise/vibration.	Disturbance and displacement of (new and existing) roosts and individuals.	✓		✓
Birds (native)	Vehicle movement.	Kill or injure individual.			✓
	Presence of the road.	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat.	✓		✓
	Lighting and noise/vibration.	Disturbance and displacement of (new and existing) nests and individuals.	✓		✓
Herpetofauna (native)	Vehicle movement.	Kill or injure individual.			✓
	Presence of the road.	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat.	✓		✓
	Lighting.	Disturbance of nocturnal lizard behaviour.	✓		✓
Freshwater habitat – wetland or stream (including riparian margins)	Vehicle (cartage) movement - risk of spills of potential toxins (oil, milk, chemicals).	Temporary degradation of instream/wetland habitat and water quality.		✓	
	Presence of bridge.	Shading leading to change in ecosystem structure.		✓	
	Gradual change in hydrology from presence of the road/stormwater, including reclamations.	Effect on downstream habitat (including erosion/sediment discharge) due to change in hydrology (increase or decrease).		✓	

Ecological feature	Activity	Ecological Effect	AUP:OP District Plan provisions	AUP:OP Regional Plan provisions	Wildlife Act (1953)
	Stormwater discharges - pollutants (such as heavy metals and herbicides).	Permanent degradation of wetland or instream habitat and water quality.		✓	
Fish (native)	Presence of culvert.	Loss of connectivity due to culvert preventing fish passage up and downstream.		✓	

4 Appendix 4 – Desktop and Incidental Fauna Records

Table 18-8 Desktop bird records within 2 km of the Project Area

Common Name	Māori Name	Scientific Name	Conservation Status	Record Source
Australasian bittern	Matuku-hūrepo	*Botaurus poiciloptilus*	Threatened - Nationally Critical	eBird (Bird Atlas)
Australasian gannet	Tākapu	*Australasian gannet*	Not Threatened	eBird (Bird Atlas)
Australasian little grebe	Tokitokipio	*Tachybaptus novaehollandiae*	Non-Resident Native - Coloniser	eBird (Bird Atlas)
Australasian shoveler	Kuruwhengi	*Spatula rhynchotis*	Not Threatened	eBird (Bird Atlas)
Australian wood duck	-	*Australian wood duck* *Chenonetta jubata*	Non-Resident Native - Coloniser	eBird (Bird Atlas)
Banded dotterel	Pohowera	*Charadrius bicinctus*	At Risk - Declining	eBird (Bird Atlas)
Banded rail	Mioweka	*Gallirallus philippensis assimilis*	At Risk - Declining	eBird (Bird Atlas)
Barbary dove	-	*Streptopelia risoria*	Introduced and Naturalised	eBird (Bird Atlas), iNaturalist
Bar-tailed godwit	Kuaka	*Limosa lapponica bauer*	At Risk - Declining	eBird (Bird Atlas), iNaturalist
Bellbird	Korimako	*Anthornis melanura*	Not Threatened	eBird (Bird Atlas)
Black shag	Kawau	*Phalacrocorax carbo novaehollandiae*	At Risk - Naturally Uncommon	eBird (Bird Atlas)
Black-billed gull	Tarāpuka	*Larus bulleri*	Threatened - Nationally Critical	eBird (Bird Atlas)
Blackbird	Manu pango	*Turdus merula*	Introduced and Naturalised	eBird (Bird Atlas), iNaturalist
Black swan	Kakīānau	*Cygnus atratus*	Not Threatened	eBird (Bird Atlas)
Brown teal	Pāteke	*Anas chlorotis*	At Risk - Recovering	eBird (Bird Atlas), iNaturalist

Common Name	Māori Name	Scientific Name	Conservation Status	Record Source
Brown quail	Kuera	*Synoicus ypsilophorus*	Introduced and Naturalised	eBird (Bird Atlas)
Buller's shearwater	Rako	*Ardenna bulleri*	At Risk - Declining	eBird (Bird Atlas)
California quail	Tikaokao	*Callipepla californica*	Introduced and Naturalised	eBird (Bird Atlas)
Canada goose	-	*Branta canadensis*	Introduced and Naturalised	eBird (Bird Atlas)
Caspian tern	Taranui	*Hydroprogne caspia*	Threatened - Nationally Vulnerable	eBird (Bird Atlas), iNaturalist
Cattle egret	-	*Bubulcus ibis*	Non-Resident Native - MIgrant	eBird (Bird Atlas)
Chaffinch	Pahirini	*Fringilla coelebs*	Introduced and Naturalised	eBird (Bird Atlas), iNaturalist
Common pheasant	Peihana	*Phasianus colchicus*	Introduced and Naturalised	eBird (Bird Atlas)
Common redpoll	-	*Acanthis flammea*	Introduced and Naturalised	eBird (Bird Atlas)
Cook’s petrel	Tītī	*Pterodroma cookii*	At Risk - Relict	eBird (Bird Atlas)
Dabchick	Weweia	*Poliocephalus rufopectus*	Threatened – Nationally Increasing	eBird (Bird Atlas)
Dunnock	-	*Prunella modularis*	Introduced and Naturalised	eBird (Bird Atlas)
Eastern rosella	-	*Platycercus eximius*	Introduced and Naturalised	eBird (Bird Atlas), iNaturalist
Fantail	Pīwakawaka	*Rhipidura fuliginosa placabilis*	Not Threatened	eBird (Bird Atlas), iNaturalist
Flesh-footed shearwater	Toanui	*Ardenna carneipes*	At Risk - Relict	eBird (Bird Atlas)
Fluttering shearwater	Pakahā	*Puffinus gavia*	At Risk - Relict	eBird (Bird Atlas)
Goldfinch	-	*Carduelis carduelis*	Introduced and Naturalised	eBird (Bird Atlas)
Greenfinch	-	*Carduelis chloris*	Introduced and Naturalised	eBird (Bird Atlas)

Common Name	Māori Name	Scientific Name	Conservation Status	Record Source
Grey duck	Pārera	*Anas superciliosa*	Threatened – Nationally Vulnerable	eBird (Bird Atlas)
Grey duck x mallard hybrid	-	*Anas platyrhynchos x superciliosa*	Not Threatened	eBird (Bird Atlas), iNaturalist
Grey teal	Tētē-moroiti	*Anas gracilis*	Not Threatened	eBird (Bird Atlas)
Grey warbler	Riroriro	*Gerygone igata*	Not Threatened	eBird (Bird Atlas), iNaturalist
Greylag goose	Kuihi	*Anser anser*	Introduced and Naturalised	eBird (Bird Atlas), iNaturalist
House sparrow	Tiu	*Fringilla coelebs*	Introduced and Naturalised	eBird (Bird Atlas), iNaturalist
Kingfisher	Kōtare	*Todiramphus sanctus vagans*	Not Threatened	eBird (Bird Atlas), iNaturalist
Laughing kookaburra	-	*Dacelo novaeguineae*	Introduced and Naturalised	eBird (Bird Atlas)
Little black shag	Kawau tūī	*Phalacrocorax sulcirostris*	At Risk - Naturally Uncommon	eBird (Bird Atlas), iNaturalist
Little shag	Kawau paka	*Phalacrocorax melanoleucos*	Not Threatened	eBird (Bird Atlas), iNaturalist
Long-tailed cuckoo	Koekoeā	*Eudynamys taitensis*	Threatened – Nationally Vulnerable	Assumed present based on suitable habitat present in the Project Area.
Magpie	Makipae	*Gymnorhina tibicen*	Introduced and Naturalised	eBird (Bird Atlas)
Mallard	-	*Anas platyrhynchos*	Introduced and Naturalised	eBird (Bird Atlas), iNaturalist
Morepork	Ruru	*Ninox novaeseelandiae*	Not Threatened	eBird (Bird Atlas)
Muscovy duck	-	*Cairina moschata*	Introduced, not established	eBird (Bird Atlas), iNaturalist
Myna	-	*Acridotheres tristis*	Introduced and Naturalised	eBird (Bird Atlas)
New Zealand dotterel	Tūturiwhatu	*Charadrius obscurus*	Threatened – Nationally Increasing	eBird (Bird Atlas)

Common Name	Māori Name	Scientific Name	Conservation Status	Record Source
New Zealand pigeon	Kereru	*Hemiphaga novaeseelandiae*	Not Threatened	eBird (Bird Atlas), iNaturalist
New Zealand pipit	Pīhoihoi	*Anthus novaeseelandiae*	At Risk - Declining	eBird (Bird Atlas)
New Zealand scaup	Pāpango	*Aythya novaeseelandiae*	Not Threatened	eBird (Bird Atlas)
North Island fernbird	Mātātā	*Poodytes punctatus*	At Risk – Declining	eBird (Bird Atlas)
North Island kākā	Kākā	*Nestor meridionalis septentrionalis*	At Risk – Recovering	eBird (Bird Atlas)
Northern blue penguin	Kororā	*Eudyptula minor iredalei*	At Risk - Declining	eBird (Bird Atlas)
Paradise shelduck	Pūtangitangi	*Tadorna variegata*	Not Threatened	eBird (Bird Atlas), iNaturalist
Peafowl	Pīkao	*Pavo cristatus*	Introduced and Naturalised	eBird (Bird Atlas)
Pied shag	Kāruhiruhi	*Phalacrocorax varius*	At Risk – Recovering	eBird (Bird Atlas), iNaturalist
Pied stilt	Poaka	*Himantopus himantopus leucocephalus*	Not Threatened	eBird (Bird Atlas)
Pūkeko	Pūkeko	*Porphyrio melanotus*	Not Threatened	eBird (Bird Atlas)
Red junglefowl (chicken)	Heihei	*Gallus gallus domesticus*	Introduced and Naturalised	eBird (Bird Atlas)
Red knot	Huahou	*Calidris canutus*	At Risk - Declining	eBird (Bird Atlas)
Red-billed gull	Tarāpunga	*Larus novaehollandiae scopulinus*	At Risk - Declining	eBird (Bird Atlas), iNaturalist
Reef heron	Matuku moana	*Egretta sacra*	Threatened – Nationally Endangered	eBird (Bird Atlas)
Rock pigeon	-	*Columba livia*	Introduced and Naturalised	eBird (Bird Atlas)
Royal spoonbill	Kōtuku ngutupapa	*Platalea regia*	At Risk – Naturally Uncommon	eBird (Bird Atlas), iNaturalist

Common Name	Māori Name	Scientific Name	Conservation Status	Record Source
Shining cuckoo	Pīpīwharauroa	*Chrysococcyx lucidus*	Not Threatened	eBird (Bird Atlas), iNaturalist
Silvereye	Tauhou	*Zosterops lateralis*	Not Threatened	eBird (Bird Atlas), iNaturalist
Skylark	Kaireka	*Alauda arvensis*	Introduced and Naturalised	eBird (Bird Atlas)
Song thrush	-	*Turdus philomelos*	Introduced and Naturalised	eBird (Bird Atlas)
South Island pied oystercatcher	Tōrea	*Haematopus finschi*	At Risk - Declining	eBird (Bird Atlas)
Southern black-backed gull	Karoro	*Larus dominicanus*	Not Threatened	eBird (Bird Atlas), iNaturalist
Spotless crake	Pūweto	*Zapornia tabuensis*	At Risk – Declining	Assumed present based on suitable habitat present in the Project Area.
Spotted dove	-	*Streptopelia chinensis tigrina*	Introduced and Naturalised	eBird (Bird Atlas), iNaturalist
Spur winged plover	-	*Vanellus miles novaehollandiae*	Not Threatened	eBird (Bird Atlas), iNaturalist
Starling	-	*Sturnus vulgaris*	Introduced and Naturalised	eBird (Bird Atlas)
Swamp harrier	Kāhu	*Circus approximans*	Not Threatened	eBird (Bird Atlas)
Tomtit	Miromiro	*Petroica macrocephala*	Not Threatened	eBird (Bird Atlas)
Tūī	Tūī	*Prosthemadera novaeseelandiae*	Not Threatened	eBird (Bird Atlas), iNaturalist
Variable oystercatcher	Tōrea pango	*Haematopus unicolor*	At Risk - Recovering	eBird (Bird Atlas)
Welcome swallow	Warou	*Hirundo neoxena*	Not Threatened	eBird (Bird Atlas), iNaturalist
White-faced heron	Matuku moana	*Egretta novaehollandiae*	Not Threatened	eBird (Bird Atlas), iNaturalist
White-faced storm petrel	Takahikare	*Pelagodroma marina*	At Risk - Relict	eBird (Bird Atlas)

Common Name	Māori Name	Scientific Name	Conservation Status	Record Source
White-fronted tern	Tara	*Sterna striata*	At Risk - Declining	eBird (Bird Atlas), iNaturalist
Wild turkey	Korukoru	*Meleagris gallopavo*	Introduced and Naturalised	eBird (Bird Atlas)
Yellowhammer	-	*Emberiza citrinella*	Introduced and Naturalised	eBird (Bird Atlas)

Table 18-9 Incidental bird observations at all NORs

Common Name	Māori Name	Scientific Name	Conservation Status	Relevant NOR
Blackbird	Manu pango	*Turdus merula*	Introduced and Naturalised	NOR 3, NOR 7
Chaffinch	Pahirini	*Fringilla coelebs*	Introduced and Naturalised	NOR 3, NOR 7, NOR 8
Common pheasant	Peihana	*Phasianus colchicus*	Introduced and Naturalised	NOR 7, NOR 7, NOR 8
Eastern rosella	-	*Platycercus eximius*	Introduced and Naturalised	NOR 7
Fantail	Pīwakawaka	*Rhipidura fuliginosa placabilis*	Not Threatened	NOR 2, NOR 5, NOR 7, NOR 8
Goldfinch	-	*Carduelis carduelis*	Introduced and Naturalised	NOR 8
Grey warbler	Riroriro	*Gerygone igata*	Not Threatened	NOR 5, NOR 7, NOR 8
House sparrow	Tiu	*Fringilla coelebs*	Introduced and Naturalised	NOR 7
Kingfisher	Kōtare	*Todiramphus sanctus vagans*	Not Threatened	NOR 2, NOR 5, NOR 7
Mallard	-	*Anas platyrhynchos*	Introduced and Naturalised	NOR 3
Myna	-	*Acridotheres tristis*	Introduced and Naturalised	NOR 2
New Zealand pigeon	Kereru	*Hemiphaga novaeseelandiae*	Not Threatened	NOR 5
Paradise shelduck	Pūtangitangi	*Tadorna variegata*	Not Threatened	NOR 3, NOR 5, NOR 7

Common Name	Māori Name	Scientific Name	Conservation Status	Relevant NOR
Pūkeko	Pūkeko	*Porphyrio melanotus*	Not Threatened	NOR 3
Skylark	Kaireka	*Alauda arvensis*	Introduced and Naturalised	NOR 6, NOR 7
Song thrush	-	*Turdus philomelos*	Introduced and Naturalised	NOR 3
Spur winged plover	-	*Vanellus miles novaehollandiae*	Not Threatened	NOR 6, NOR 7
Starling	-	*Sturnus vulgaris*	Introduced and Naturalised	NOR 5, NOR 8
Swamp harrier	Kāhu	*Circus approximans*	Not Threatened	NOR 2, NOR 3, NOR 5, NOR 6, NOR 7
Tūī	Tūī	*Prosthemadera novaeseelandiae*	Not Threatened	NOR 2, NOR 7, NOR 8
Welcome swallow	Warou	*Hirundo neoxena*	Not Threatened	NOR 2, NOR 6, NOR 7

5 Appendix 5 – Ecological Habitat Maps

5.1 NOR 1: Northern Public Transport Interchange and Park & Ride, and Western Link - North Western Link - North

5.1.1 Terrestrial Vegetation

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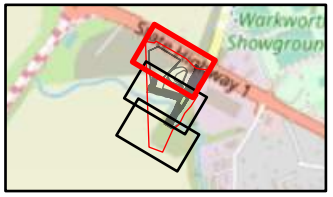
LEGEND

Route Option

Designation



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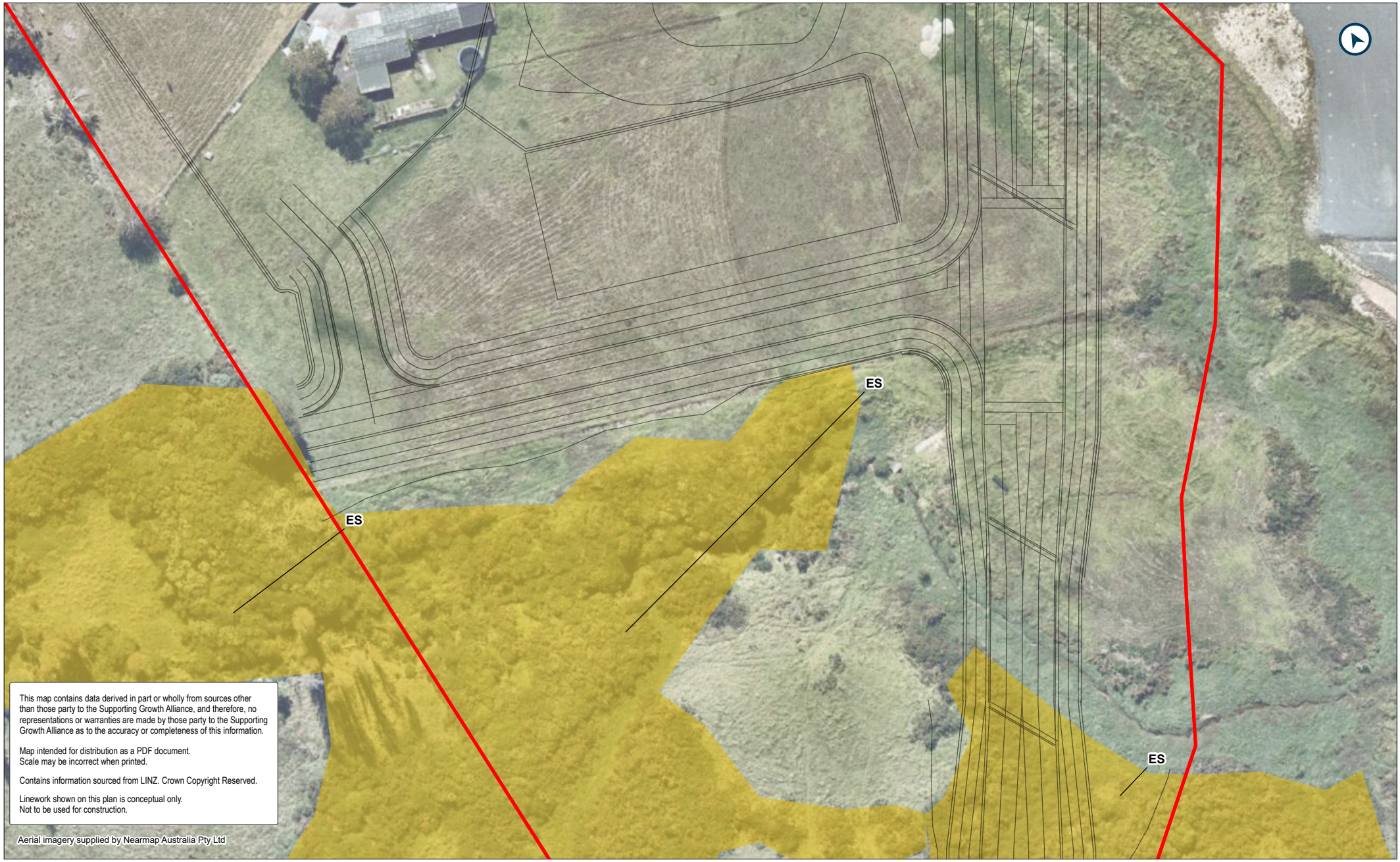

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LEGEND

Route Option

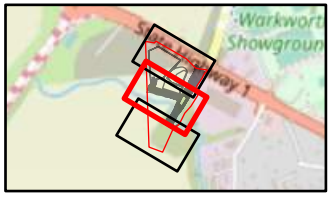
Designation

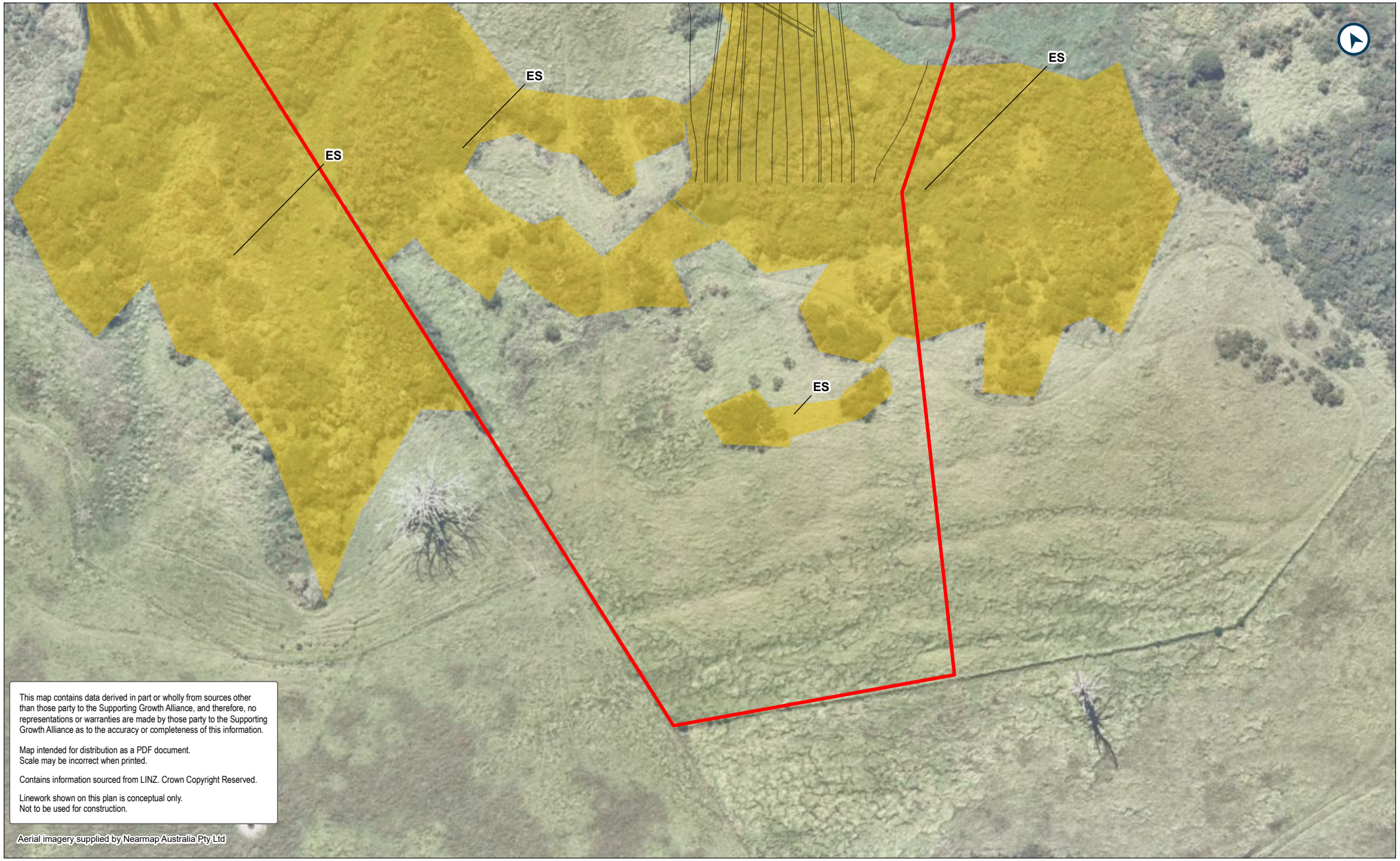
Habitat mapping

ES

0 20 40

Metres





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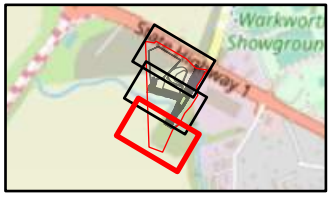
LEGEND

Route Option

Designation

Habitat mapping

ES



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Metres

5.1.2 Freshwater Streams and Wetland Habitat

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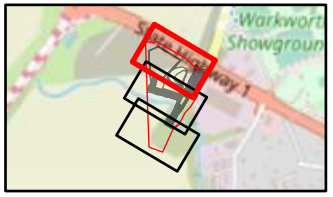
LEGEND

Route Option

Designation

Stream classification
Permanent

Habitat mapping
EW



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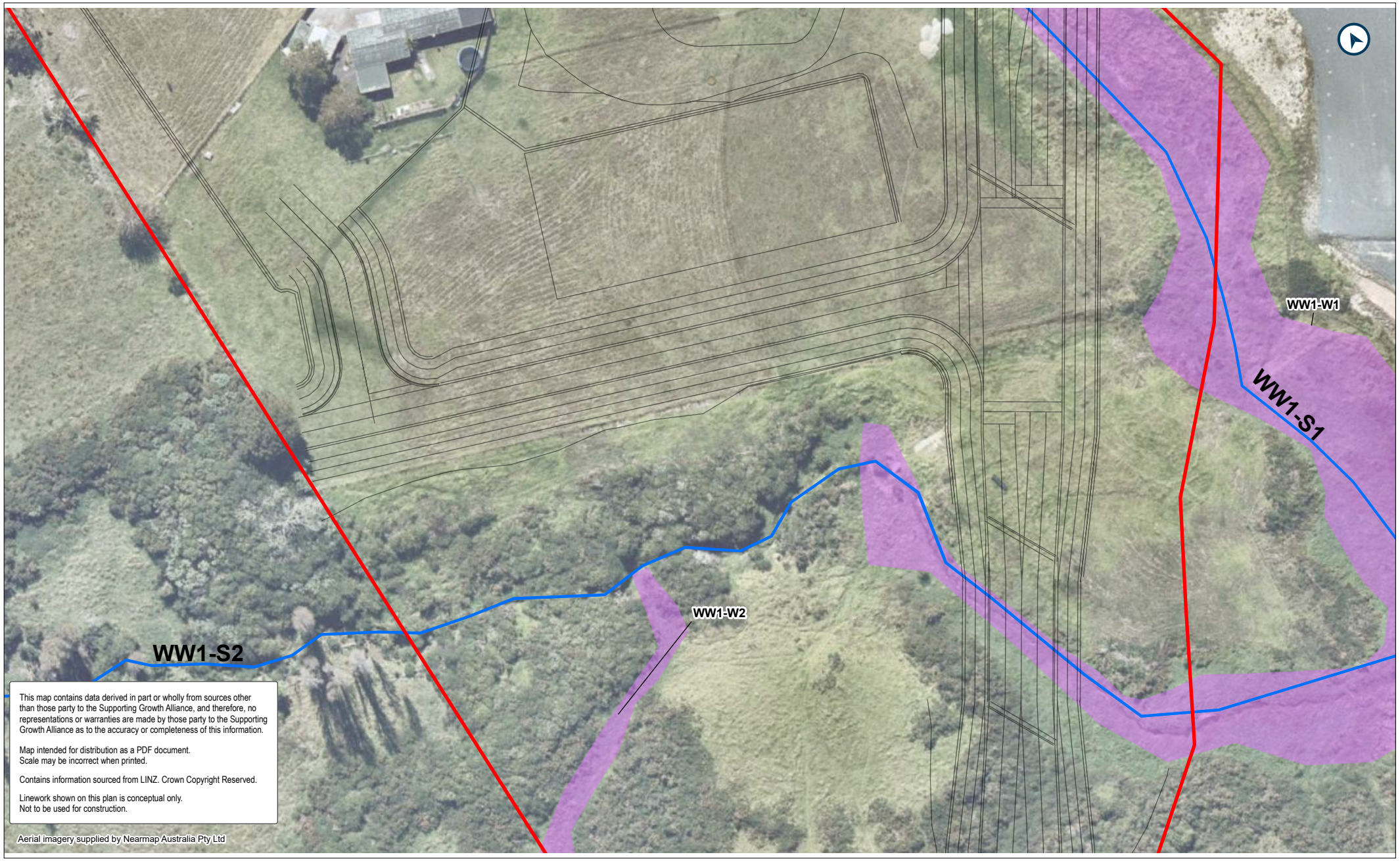
Metres

509



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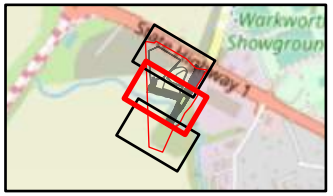
LEGEND

- Route Option
- Designation
- Stream classification
  - Permanent
- Habitat mapping
  - EW



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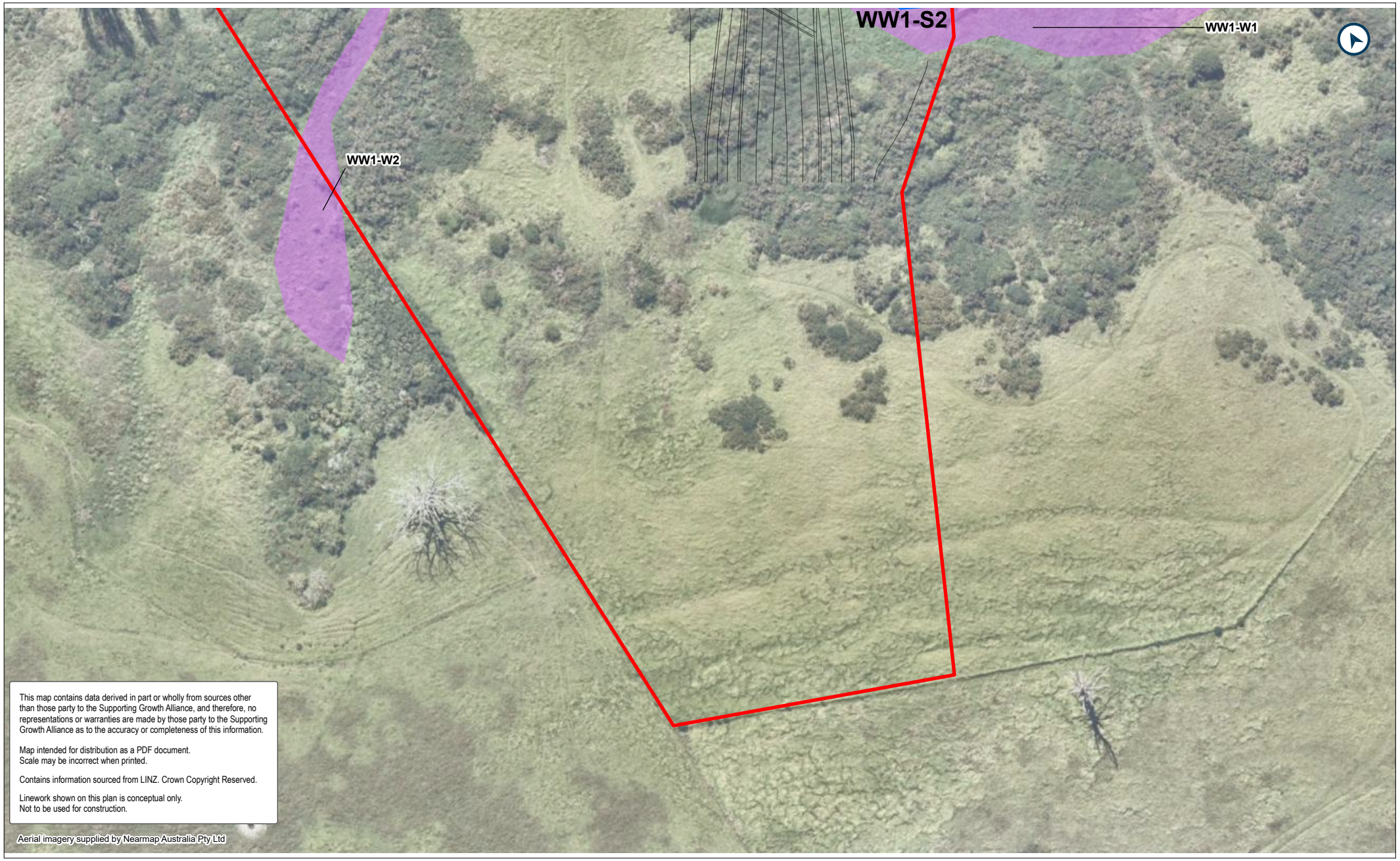

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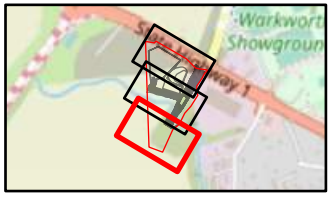
- Route Option
- Designation
- Stream classification
  - Permanent
- Habitat mapping
  - EW



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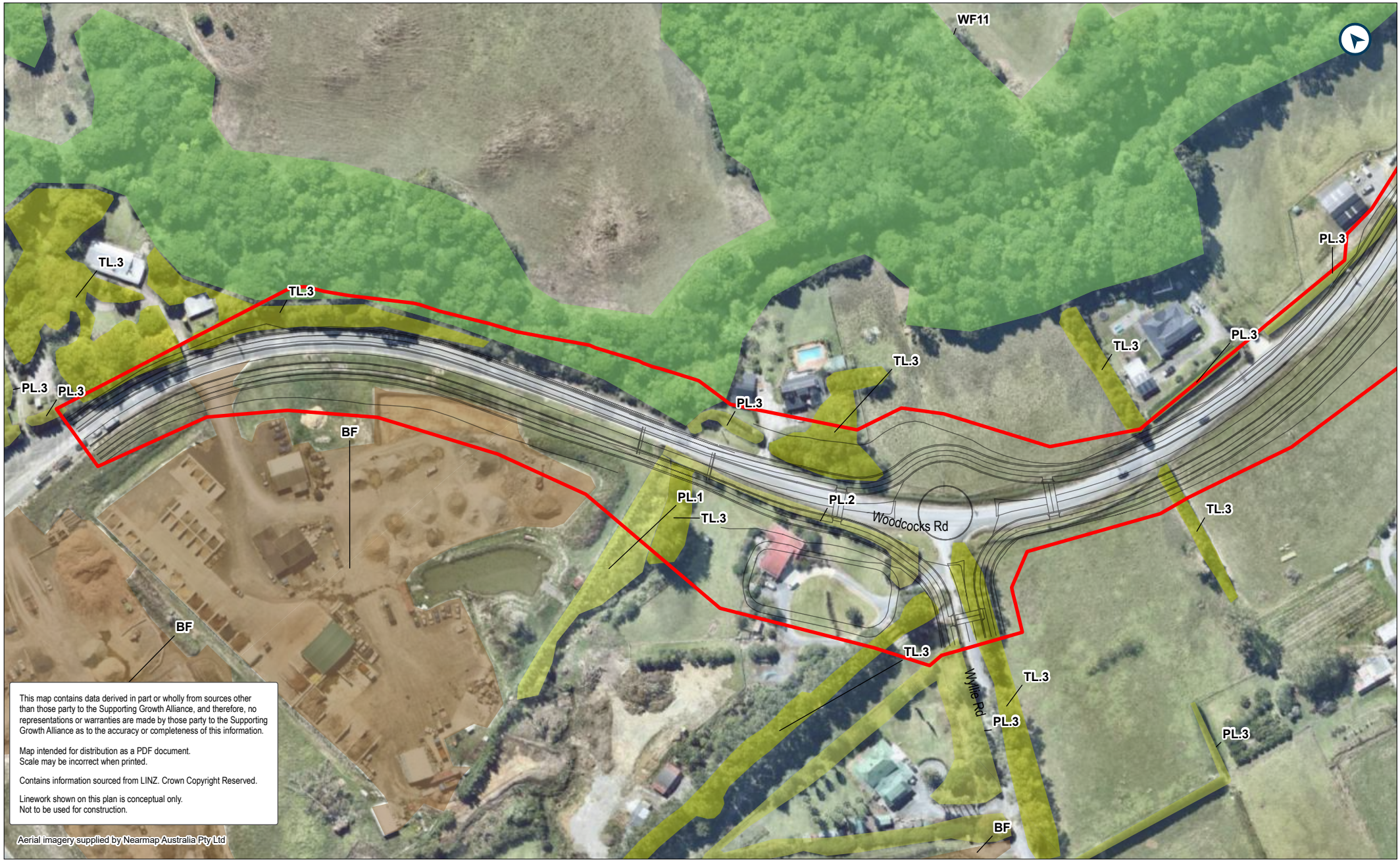
Metres

511

5.2 NOR 2: Woodcocks Road Upgrade (Western Section)

5.2.1 Terrestrial Vegetation



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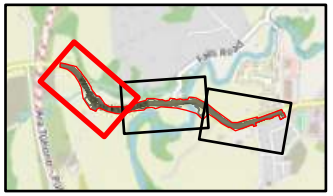
LEGEND

Route Option
Designation

Habitat mapping
BF
PL.1
PL.2
PL.3
TL.3
WF11



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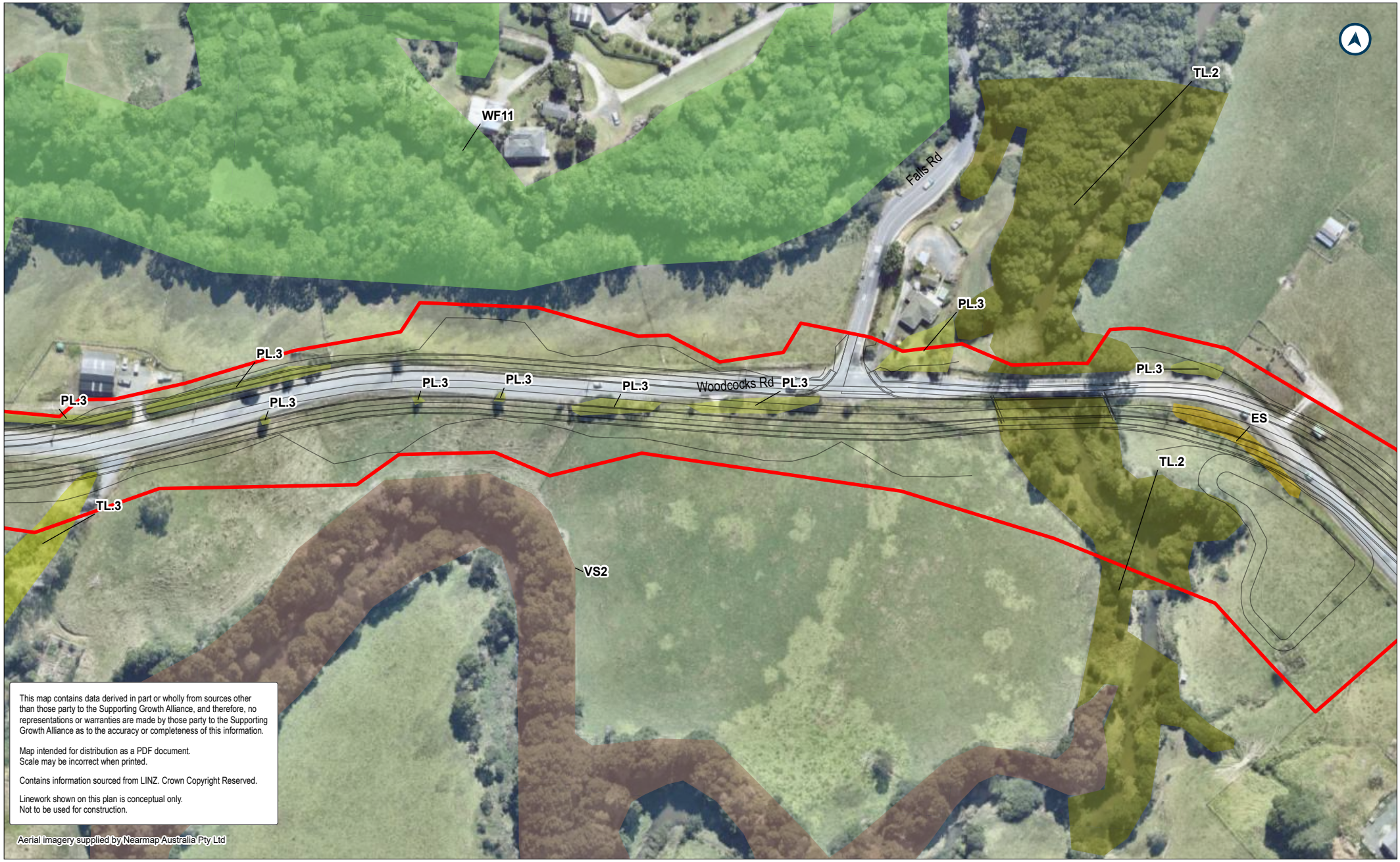

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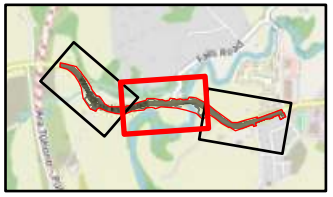
LEGEND

Route Option
Designation

Habitat mapping
ES
PL.3
TL.2
TL.3
VS2
WF11

0 40 80
Metres



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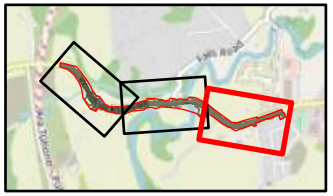
LEGEND

Route Option
Designation

Habitat mapping
PL.1
PL.3
TL.2
TL.3

0 40 80
Metres



5.2.2 Freshwater Streams and Wetland Habitat

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LEGEND

Route Option

Designation

Stream classification

Permanent

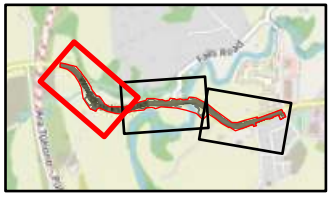
Habitat mapping

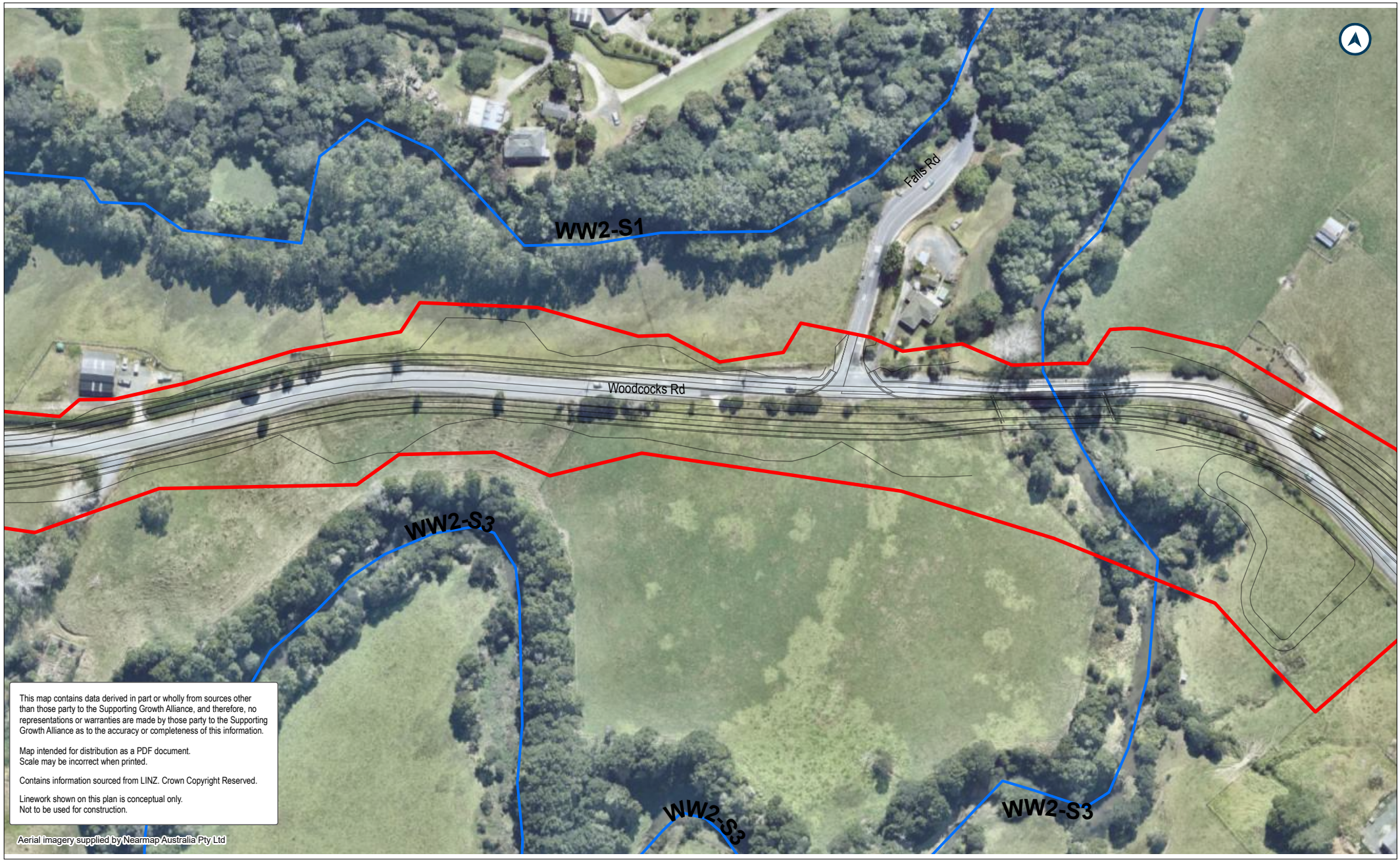
EW

OW

0 40 80

Metres





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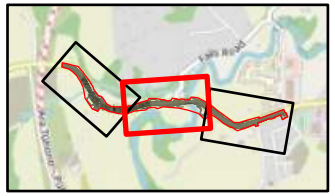
LEGEND

Route Option

Designation

Stream classification

Permanent



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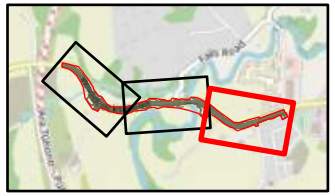
LEGEND

Route Option

Designation

Stream classification
Intermittent

Habitat mapping
EW



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Metres

519

5.3 NOR 3: State Highway 1 Upgrade (Southern Section)

5.3.1 Terrestrial Vegetation

Name of Map: SGA-EC-WW-030-Habitat-mapping-terrestrial-vegetation-SH1

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LEGEND

Route Option
Designation

Habitat mapping
PL.1
PL.3
TL
TL.3

0 30 60
Metres

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Name of Map: SGA-EC-WW-030-Habitat-mapping-terrestrial-vegetation-SH1

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LEGEND

Route Option
Designation

Habitat mapping
ES
PL.1
PL.3
TL
TL.3

0 30 60
Metres

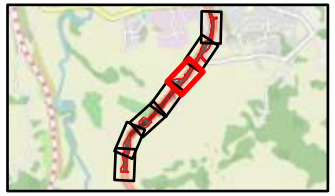
Name of Map: SGA-EC-WW-030-Habitat-mapping-terrestrial-vegetation-SH1

Path: \\Beca.net\projects\38\13810934\TG\01 Maps\06 ArcGIS Pro\01 Warkworth\SGA_Warkworth_Ecology_Figures.aprx

LEGEND

Route Option
Designation

Habitat mapping
ES
PL.1
PL.3
TL.2
TL.3



0 30 60
Metres

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LEGEND

Route Option
Designation

Habitat mapping
PL.1
PL.3
TL.1
TL.3

0 30 60
Metres

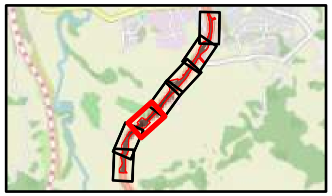
Name of Map: SGA-EC-WW-030-Habitat-mapping-terrestrial-vegetation-SH1

Path: \\Beca.net\projects\3813810934\TG\01 Map\06 ArcGIS Pro\01 Warkworth\SGA_Warkworth_Ecology_Figures.aprx

LEGEND

Route Option
Designation

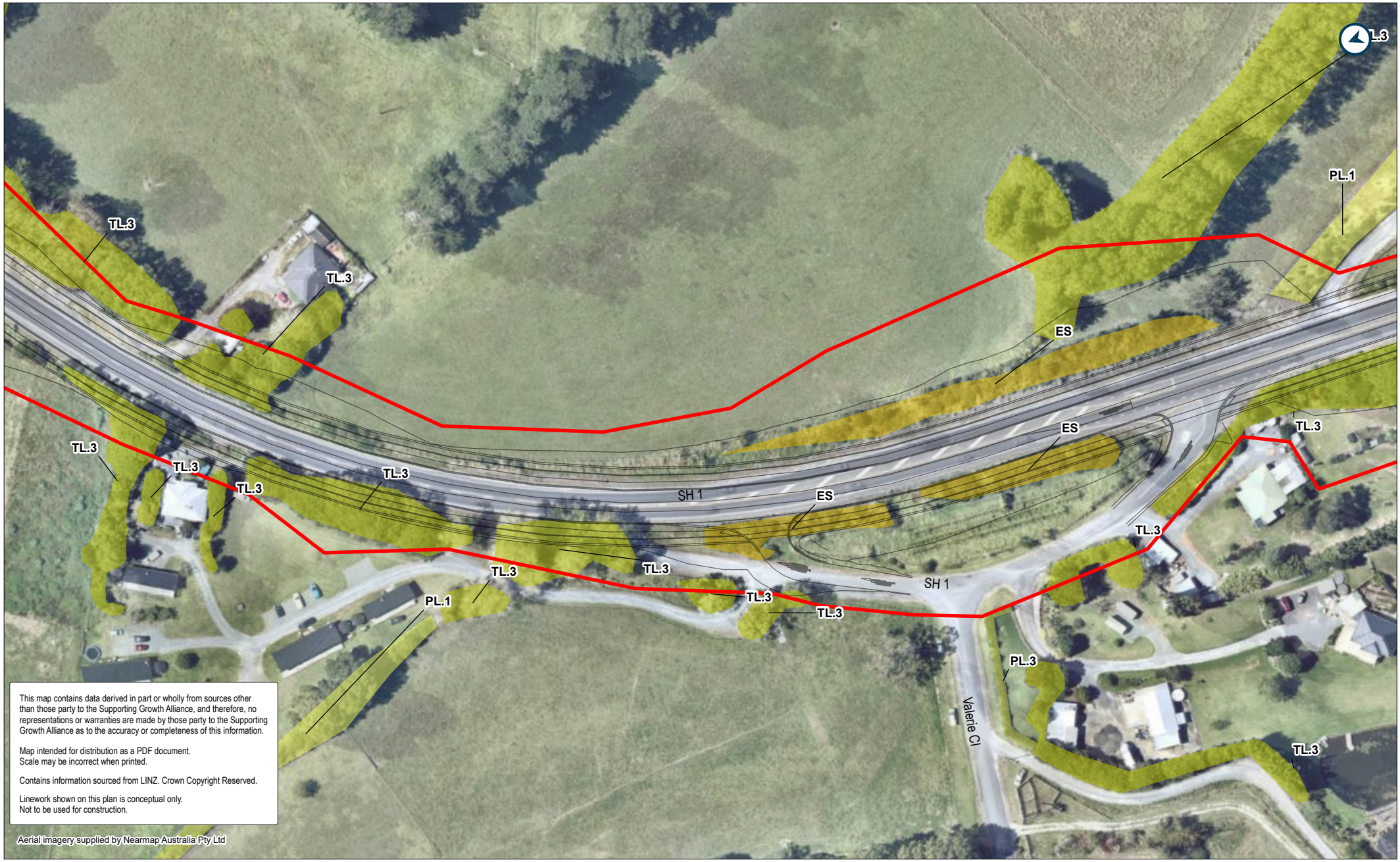
Habitat mapping
PL.1
PL.3
TL.1
TL.3



0 30 60
Metres

ATTACHMENT 66

ASSESSMENT OF ECOLOGICAL EFFECTS
PART 3 OF 5



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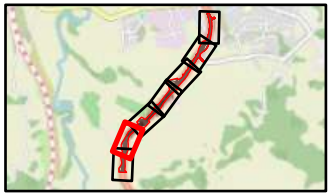
Path: \\Beca.net\projects\381\381093\4\TG\01 Maps\06 ArcGIS Pro\01 Warkworth\SGA_Warkworth_Ecology_Figures.aprx

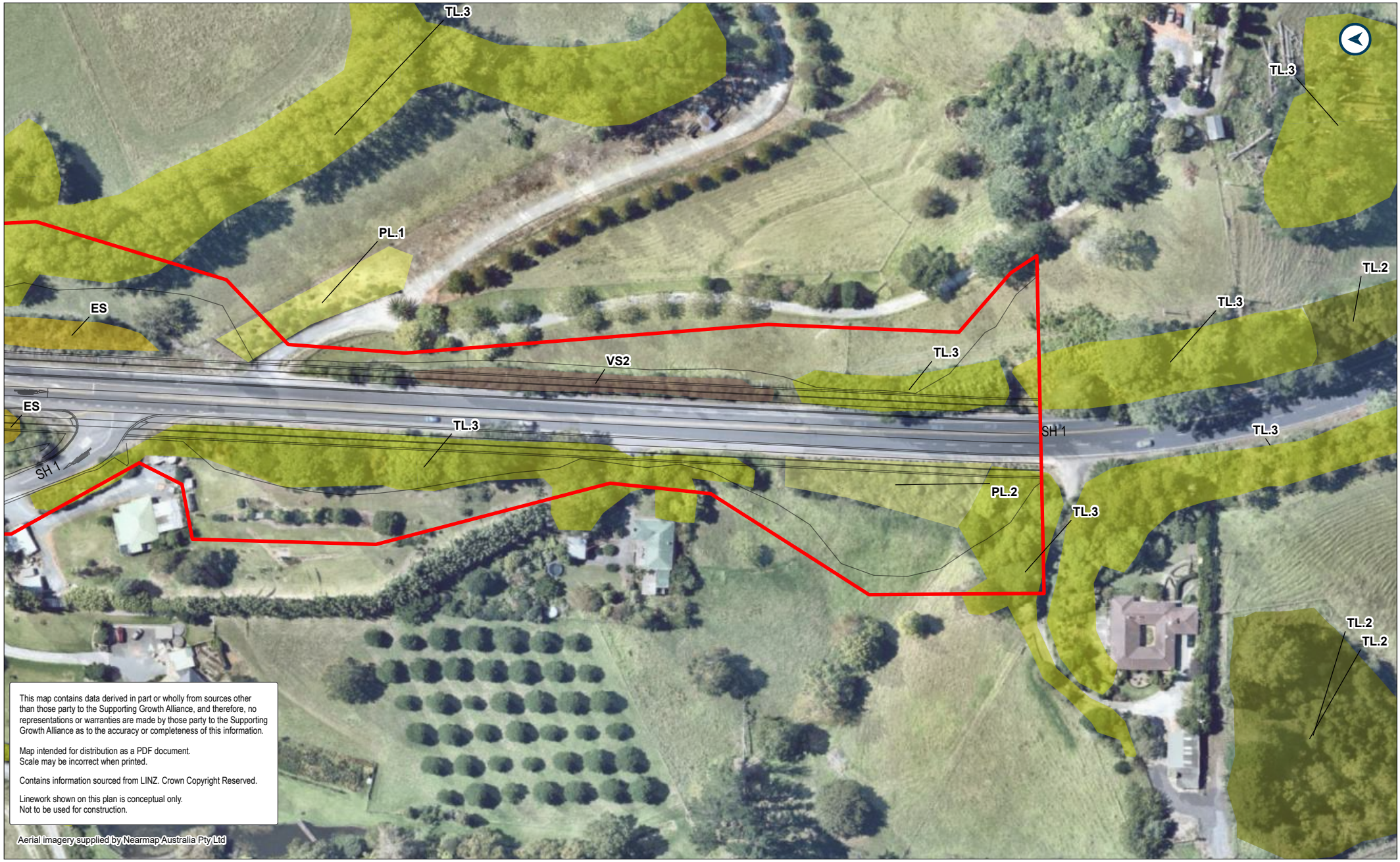
LEGEND

Route Option
Designation

Habitat mapping
ES
PL.1
PL.3
TL.3



0 30 60
Metres



Name of Map: SGA-EC-WW-030-Habitat-mapping-terrestrial-vegetation-SH1

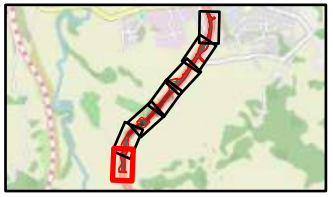
Path: \\Beca.net\projects\3813810934\TG\01 Maps\06 ArcGIS Pro\01 Warkworth\SGA_Warkworth_Ecology_Figures.aprx

LEGEND

Route Option
Designation

Habitat mapping
ES
PL.1
PL.2
TL.2
TL.3
VS2

0 30 60
Metres



530

5.3.2 Freshwater Streams and Wetland Habitat

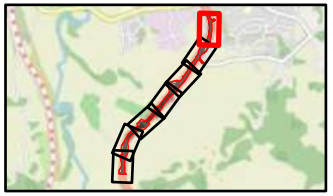
Name of Map: SGA-EC-WW-039-Habitat-mapping-streams-and-wetlands-SH1

Path: \\Beca.net\projects\381\38109304\TG\01 Maps\06 ArcGIS Pro\01 Warkworth\SGA_Warkworth_Ecology_Figures.aprx

LEGEND

Route Option
Designation

Stream classification
Artificial ditch
swale/drainage
Intermittent
Permanent



0 30 60
Metres

Name of Map: SGA-EC-WW-039-Habitat-mapping-streams-and-wetlands-SH1

Path: \\Beca.net\projects\38\130810934\TG\01 Maps\06 ArcGIS Pro\01 Warkworth\SGA_Warkworth_Ecology_Figures.aprx

LEGEND

Route Option

Designation

Stream classification

Artificial ditch

swale/drainage

Habitat mapping

EW

0 30 60

Metres

Name of Map: SGA-EC-WW-039-Habitat-mapping-streams-and-wetlands-SH1
Path: \\Beca.net\projects\38\138109\94\TG\01 Maps\06 ArcGIS Pro\01 Warkworth\SGA_Warkworth_Ecology_Figures.aprx

LEGEND

- Route Option
- Designation

Stream classification
- Artificial ditch
- swale/drainage
- Artificial/Piped/Culvert
- Permanent

Habitat mapping
- EW
- OW

0 30 60
Metres

Name of Map: SGA-EC-WW-039-Habitat-mapping-streams-and-wetlands-SH1

Path: \\Beca.net\projects\3813810934\TG\01 Map\06 ArcGIS Pro\01 Warkworth\SGA_Warkworth_Ecology_Figures.aprx

LEGEND

Route Option
Designation

Stream classification
Artificial ditch
swale/drainage
Artificial/Piped/Culvert
Permanent

Habitat mapping
EW

0 30 60
Metres

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Path: \\Beca.net\projects\38\13810934\TG\01 Maps\06 ArcGIS Pro\01 Warkworth\SGA_Warkworth_Ecology_Figures.aprx

LEGEND

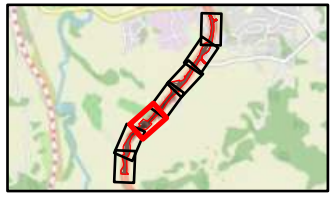
Route Option

Designation

Stream classification

Artificial/Piped/Culvert

Permanent



0 30 60

Metres

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Path: \\Beca.net\projects\38\138109\94\TG\01 Maps\06 ArcGIS Pro\01 Warkworth\SGA_Warkworth_Ecology_Figures.aprx

LEGEND

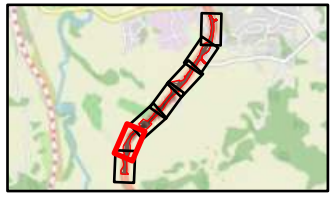
Route Option

Designation

Stream classification

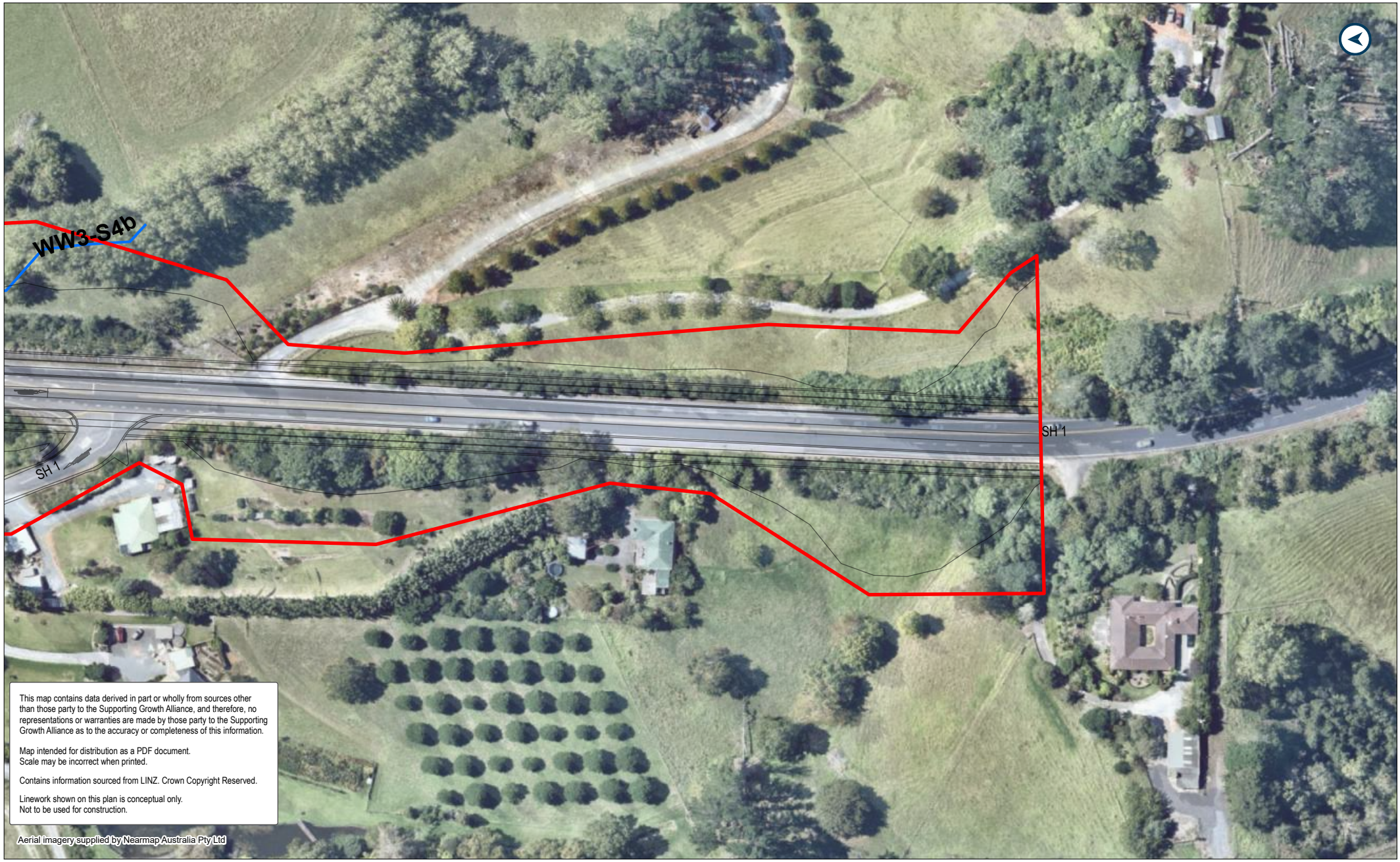
Artificial/Piped/Culvert

Permanent



0 30 60

Metres



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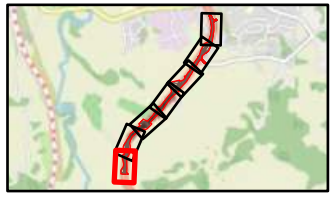
Path: \\Beca.net\projects\38\138109\34\TG\01 Maps\06 ArcGIS Pro\01 Warkworth\SGA_Warkworth_Ecology_Figures.aprx

LEGEND

Route Option

Designation

Stream classification
Permanent



0 30 60
Metres

5.4 NOR 4: Matakana Road Upgrade

5.4.1 Terrestrial Vegetation

LEGEND

Route Option
Designation

Habitat mapping
PL.3
TL
TL.1
TL.2
TL.3
WF11
WF13

0 50 100
Metres

Name of Map: SGA-EC-WW-024-Habitat-mapping-terrestrial-vegetation-MK

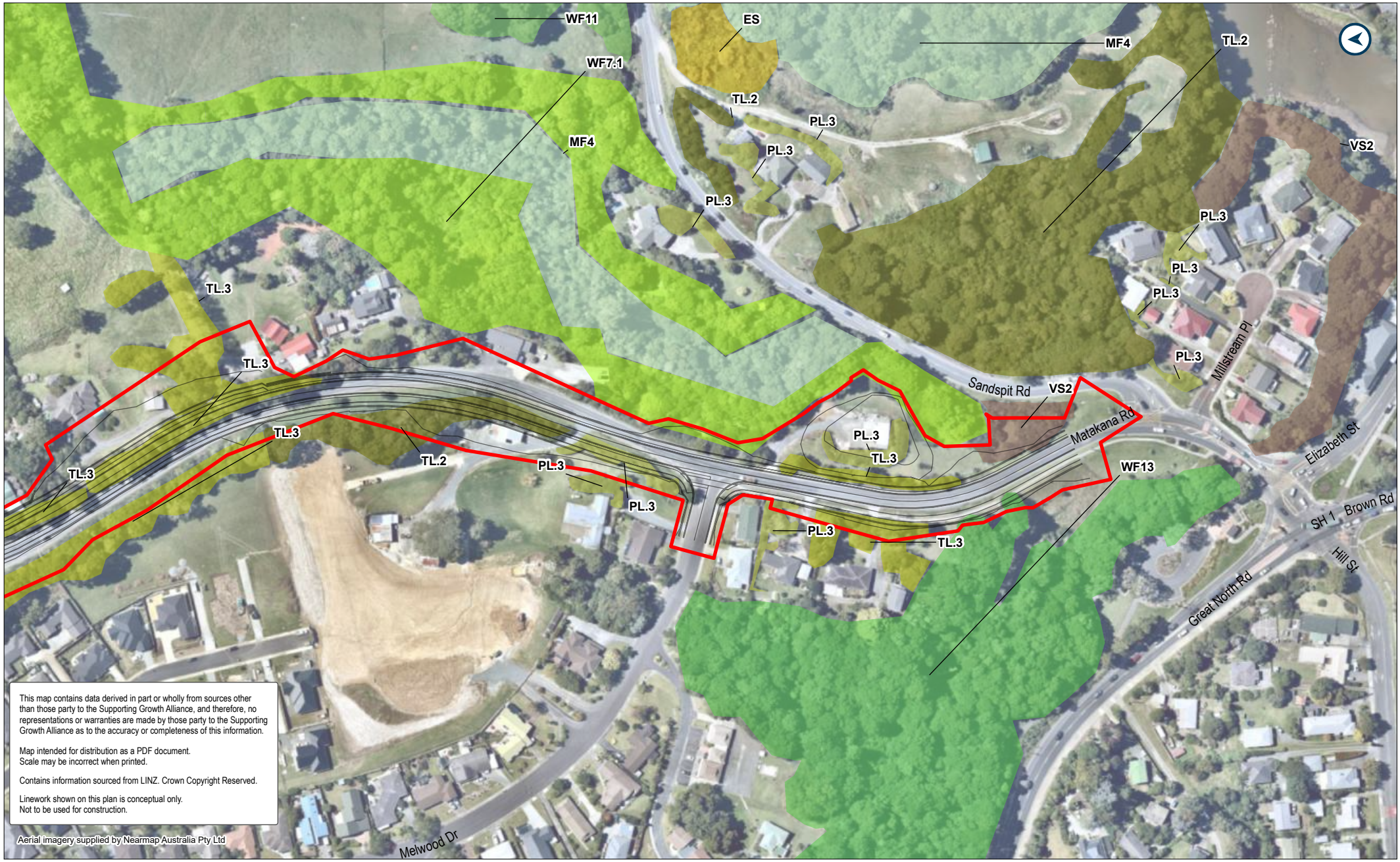
Path: \\Beca.net\projects\38\138109\34\TG\01 Maps\06 ArcGIS Pro\01 Warkworth\SGA_Warkworth_Ecology_Figures.aprx

LEGEND

Route Option
Designation

Habitat mapping
PL.1
PL.2
PL.3
TL.2
TL.3
WF13
WF7.1

0 50 100
Metres



Name of Map: SGA-EC-WW-024-Habitat-mapping-terrestrial-vegetation-MK

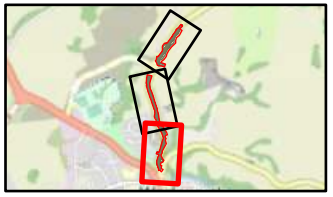
Path: \\Beca.net\projects\38\138109\34\TG\01 Maps\06 ArcGIS Pro\01 Warkworth\SGA_Warkworth_Ecology_Figures.aprx

LEGEND

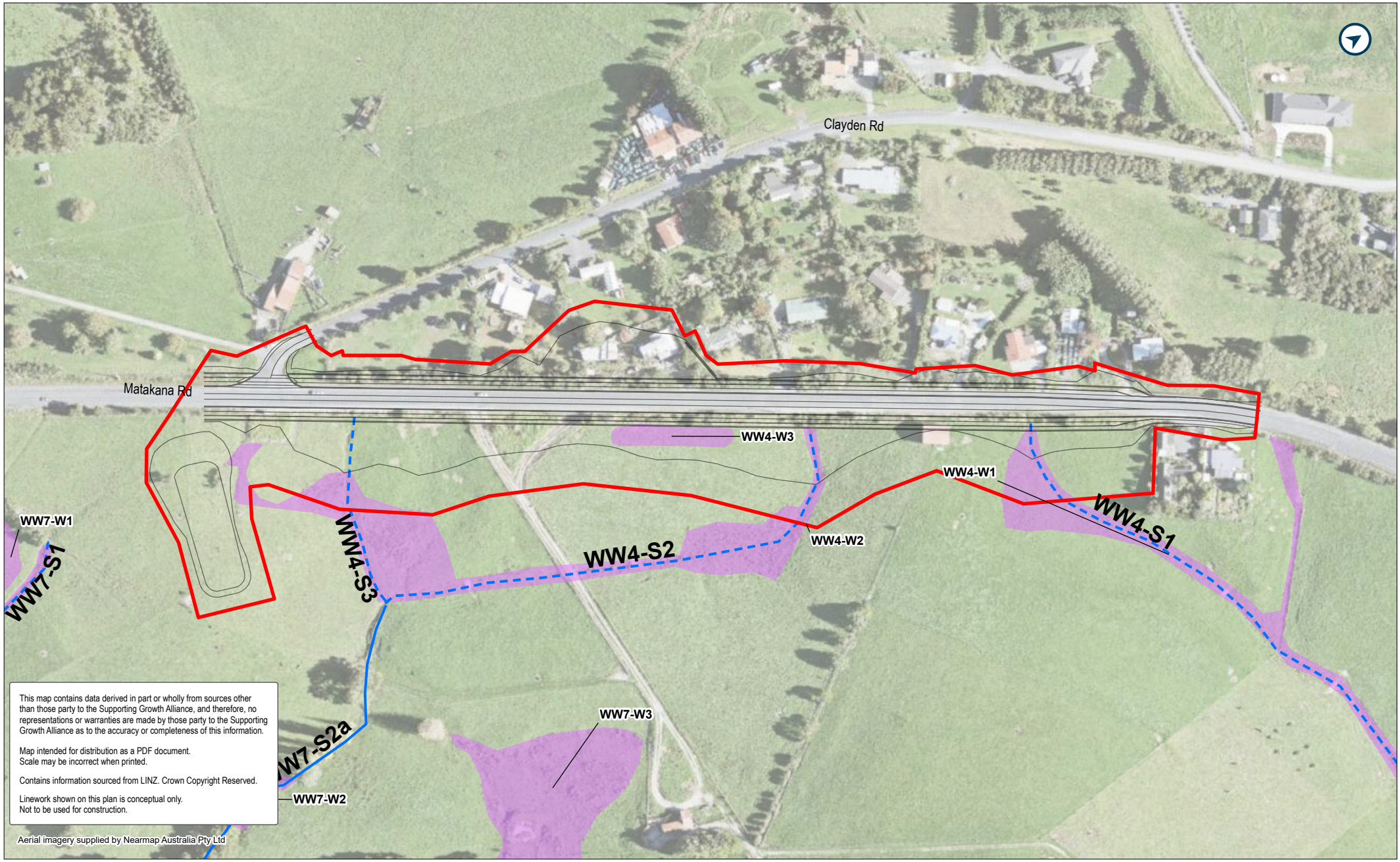
Route Option
Designation

Habitat mapping
ES
MF4
PL.3
TL.2
TL.3
VS2
WF11
WF13
WF7.1

0 50 100
Metres



5.4.2 Freshwater Streams and Wetland Habitat



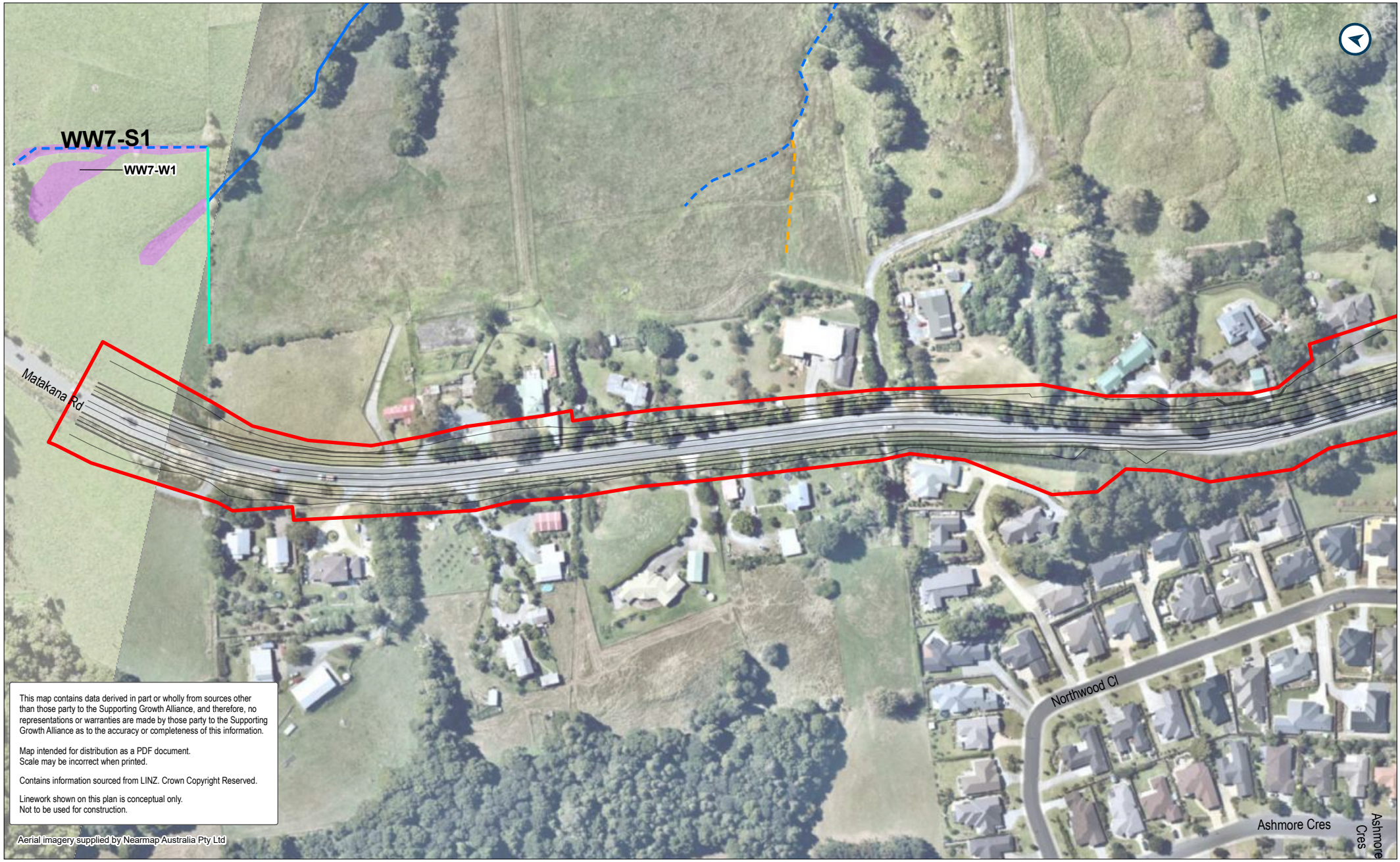
Name of Map: SGA-EC-WW-033-Habitat-mapping-streams-and-wetlands-MK

Path: \\Beca.net\projects\38\130934\TG\01 Maps\06 ArcGIS Pro\01 Warkworth\SGA_Warkworth_Ecology_Figures.aprx

LEGEND

- Route Option
- Designation
- Stream classification
  - Intermittent
  - Permanent
- Habitat mapping
  - EW

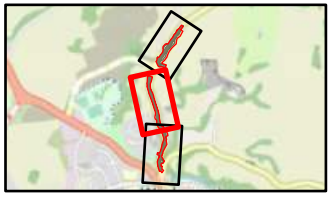
0 50 100
Metres

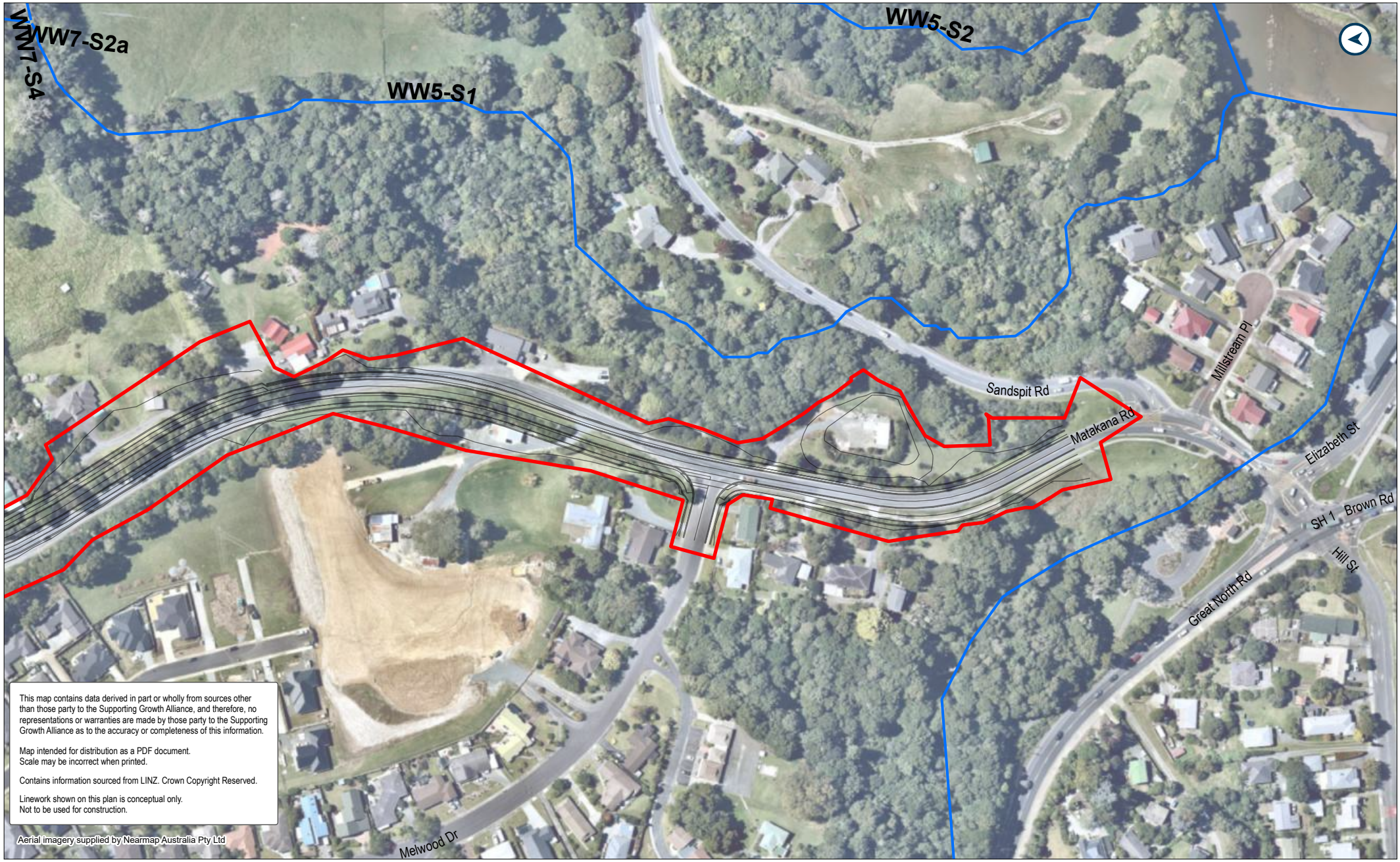


LEGEND

- Route Option
- Designation
- Stream classification
  - Artificial swale/drainage ditch
  - Ephemeral
  - Intermittent
  - Permanent
- Habitat mapping
  - EW

0 50 100
Metres





Name of Map: SGA-EC-WW-033-Habitat-mapping-streams-and-wetlands-MK

Path: \\Beca.net\projects\38\13810934\TG\01 Maps\06 ArcGIS Pro\01 Warkworth\SGA_Warkworth_Ecology_Figures.aprx

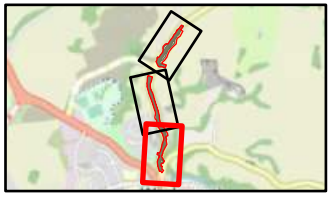
LEGEND

Route Option

Designation

Stream classification

Permanent



0 50 100

Metres

5.5 NOR 5: Sandspit Road Upgrade

5.5.1 Terrestrial Vegetation

Name of Map: SGA-EC-WW-026-Habitat-mapping-terrestrial-vegetation-SP

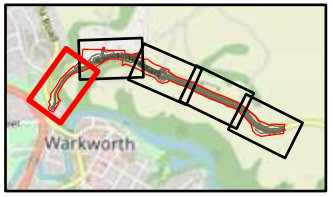
Path: \\Beca.net\projects\38\138109\34\TG\01 Maps\06 ArcGIS Pro\01 Warkworth\SGA_Warkworth_Ecology_Figures.aprx

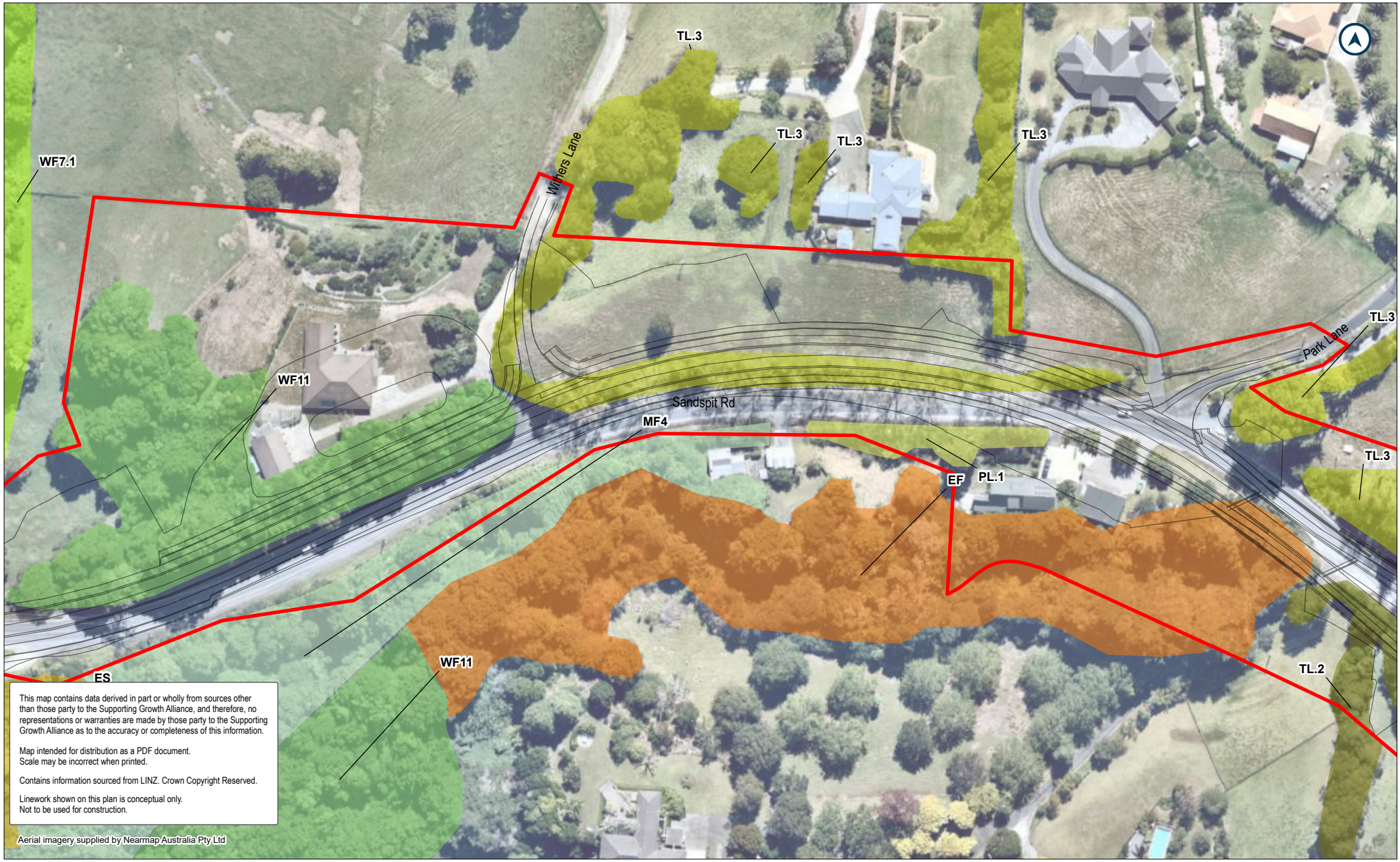
LEGEND

Route Option
Designation

Habitat mapping
ES
MF4
PL.3
TL.2
TL.3
VS2
WF11
WF13
WF7.1

0 30 60
Metres





Name of Map: SGA-EC-WW-026-Habitat-mapping-terrestrial-vegetation-SP

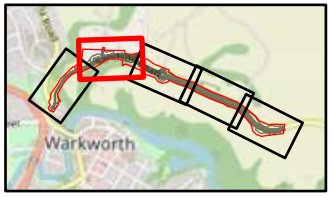
Path: \\Beca.net\projects\38\13810934\TG\01 Maps\06 ArcGIS Pro\01 Warkworth\SGA_Warkworth_Ecology_Figures.aprx

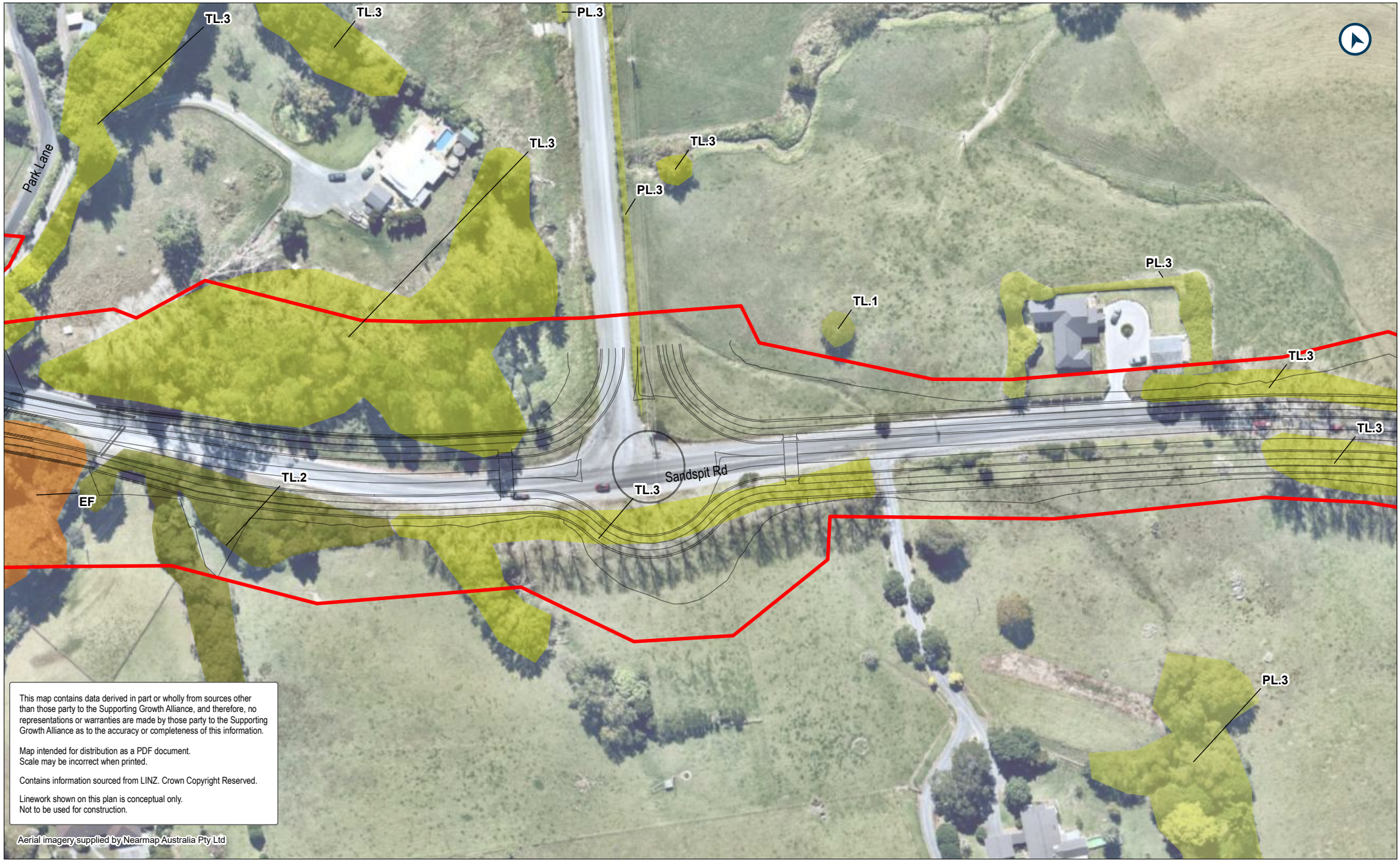
LEGEND

Route Option
Designation

Habitat mapping
EF
ES
MF4
PL.1
TL.2
TL.3
WF11
WF7.1

0 30 60
Metres





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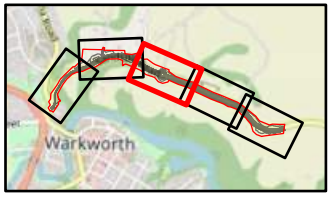
LEGEND

Route Option
Designation

Habitat mapping
EF
PL.3
TL.1
TL.2
TL.3

0 30 60
Metres



Name of Map: SGA-EC-WW-026-Habitat-mapping-terrestrial-vegetation-SP

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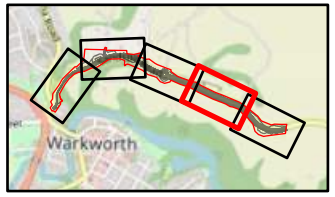
LEGEND

Route Option
Designation

Habitat mapping
ES
PL.3
TL.3



0 30 60
Metres

Name of Map: SGA-EC-WW-026-Habitat-mapping-terrestrial-vegetation-SP

Path: \\Beca.net\projects\38\130810934\TG\01 Maps\06 ArcGIS Pro\01 Warkworth\SGA_Warkworth_Ecology_Figures.aprx

LEGEND

Route Option

Designation

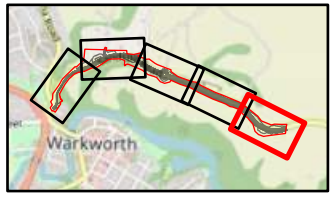
Habitat mapping

TL.3

PL.3

0 30 60

Metres



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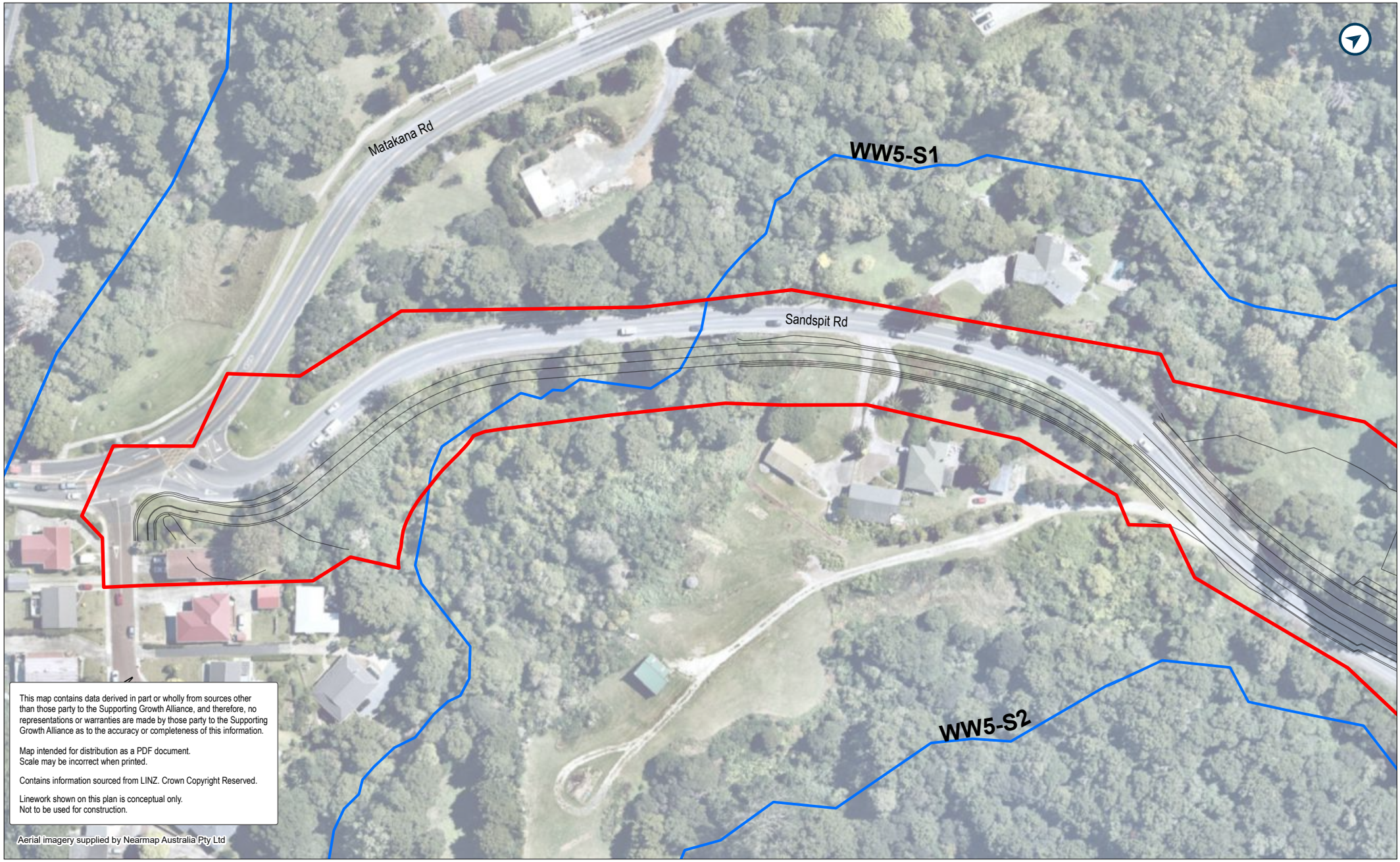
5.5.2 Freshwater Streams and Wetland Habitat



Name of Map: SGA-EC-WW-035-Habitat-mapping-streams-and-wetlands-SP
Path: \\Beca.net\projects\38\138109\94\TG\01 Maps\06 ArcGIS Pro\01 Warkworth\SGA_Warkworth_Ecology_Figures.aprx

LEGEND

Route Option

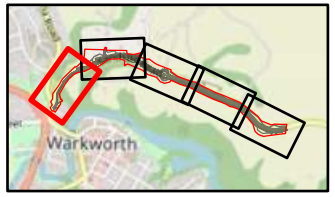
Designation

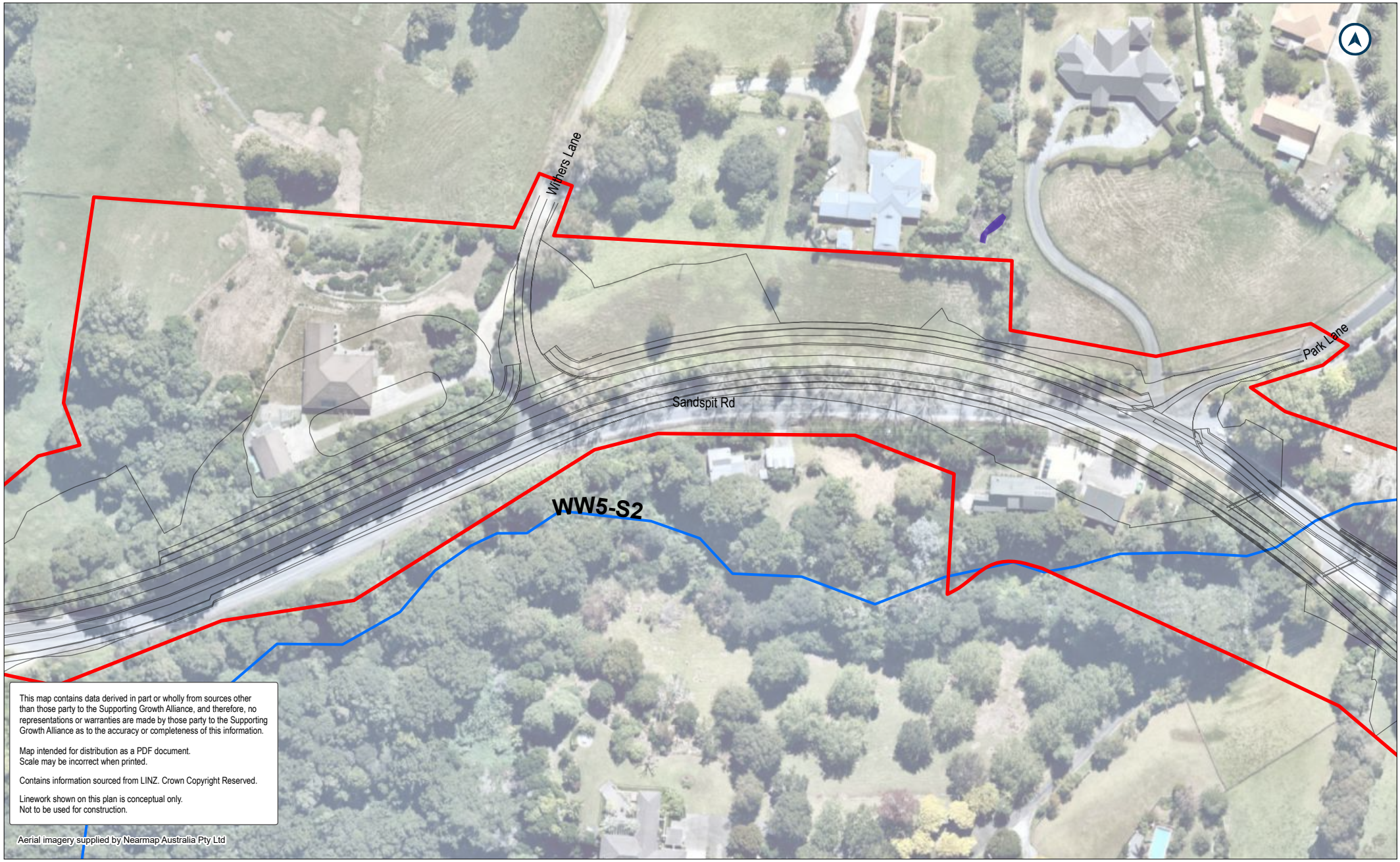
Stream classification

Permanent

0 30 60

Metres





Name of Map: SGA-EC-WW-035-Habitat-mapping-streams-and-wetlands-SP

Path: \\Beca.net\projects\38\10810934\TG\01 Maps\06 ArcGIS Pro\01 Warkworth\SGA_Warkworth_Ecology_Figures.aprx

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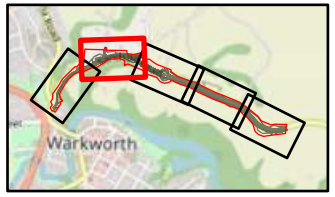
LEGEND

- Route Option
- Designation
- Stream classification
  - Permanent
- Habitat mapping
  - OW

0 30 60
Metres



555

Name of Map: SGA-EC-WW-035-Habitat-mapping-streams-and-wetlands-SP

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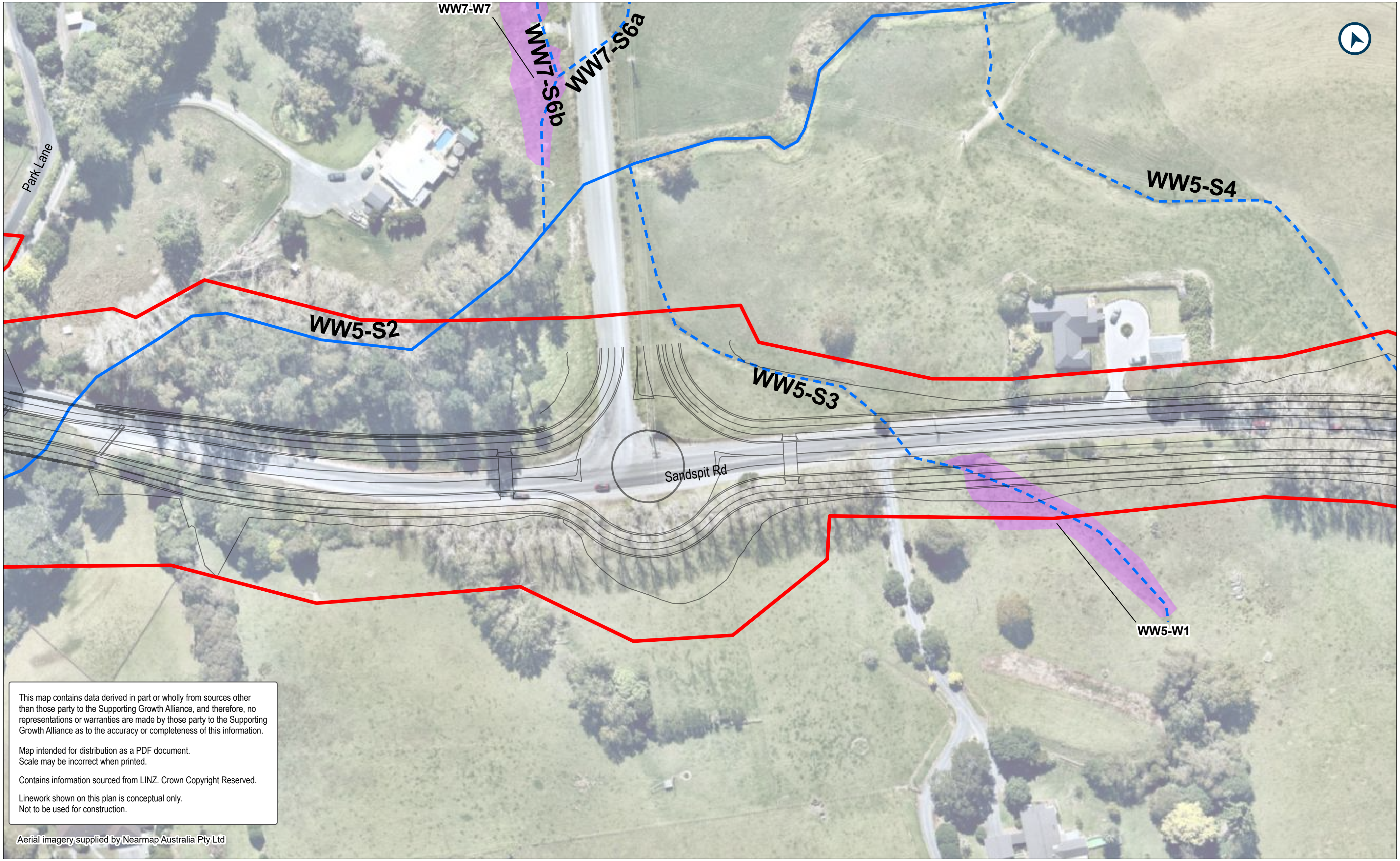

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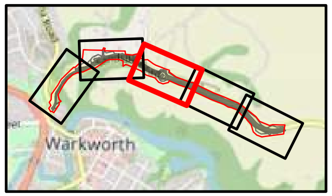
LEGEND

Route Option

Designation

Stream classification
- Intermittent
- Permanent

Habitat mapping
- EW



0 30 60
Metres

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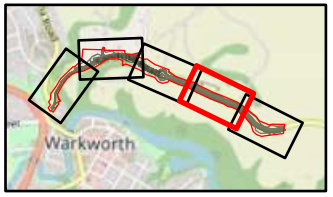
Name of Map: SGA-EC-WW-035-Habitat-mapping-streams-and-wetlands-SP

Path: \\Beca.net\projects\38\110934\TG\01 Maps\06 ArcGIS Pro\01 Warkworth\SGA_Warkworth_Ecology_Figures.aprx

LEGEND

- Route Option
- Designation
- Stream classification
  - Intermittent
  - Permanent
- Habitat mapping
  - EW



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Metres

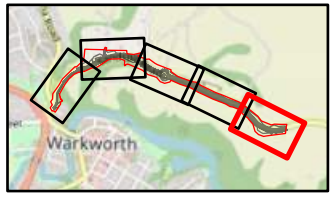
LEGEND

Route Option

Designation

Stream classification
Permanent

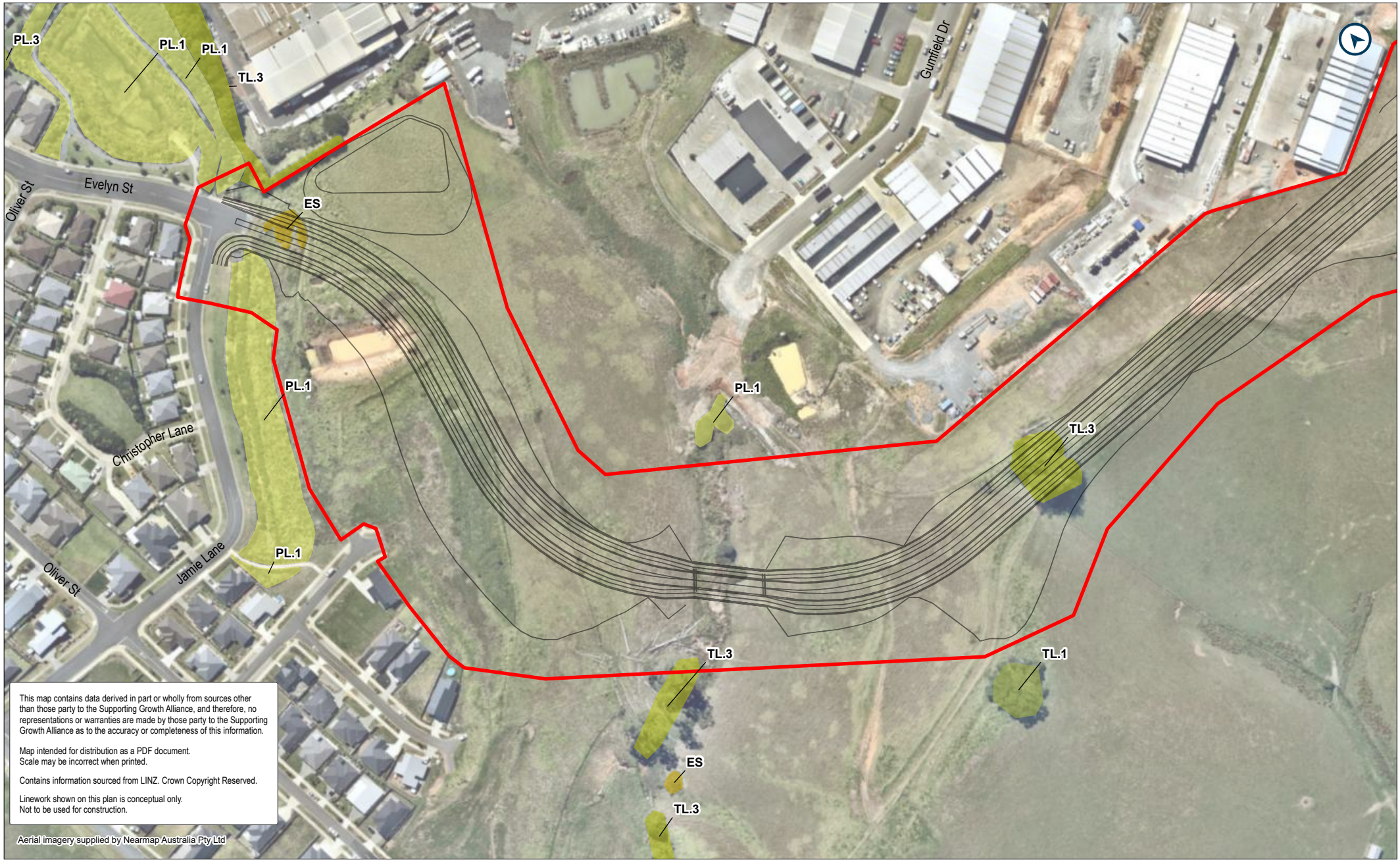
Habitat mapping
EW



0 30 60
Metres

5.6 NOR 6: New Western Link South

5.6.1 Terrestrial Vegetation



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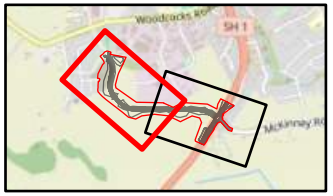
LEGEND

Route Option
Designation

Habitat mapping
ES
PL.1
PL.3
TL.1
TL.3



0 50 100
Metres

ATTACHMENT 67

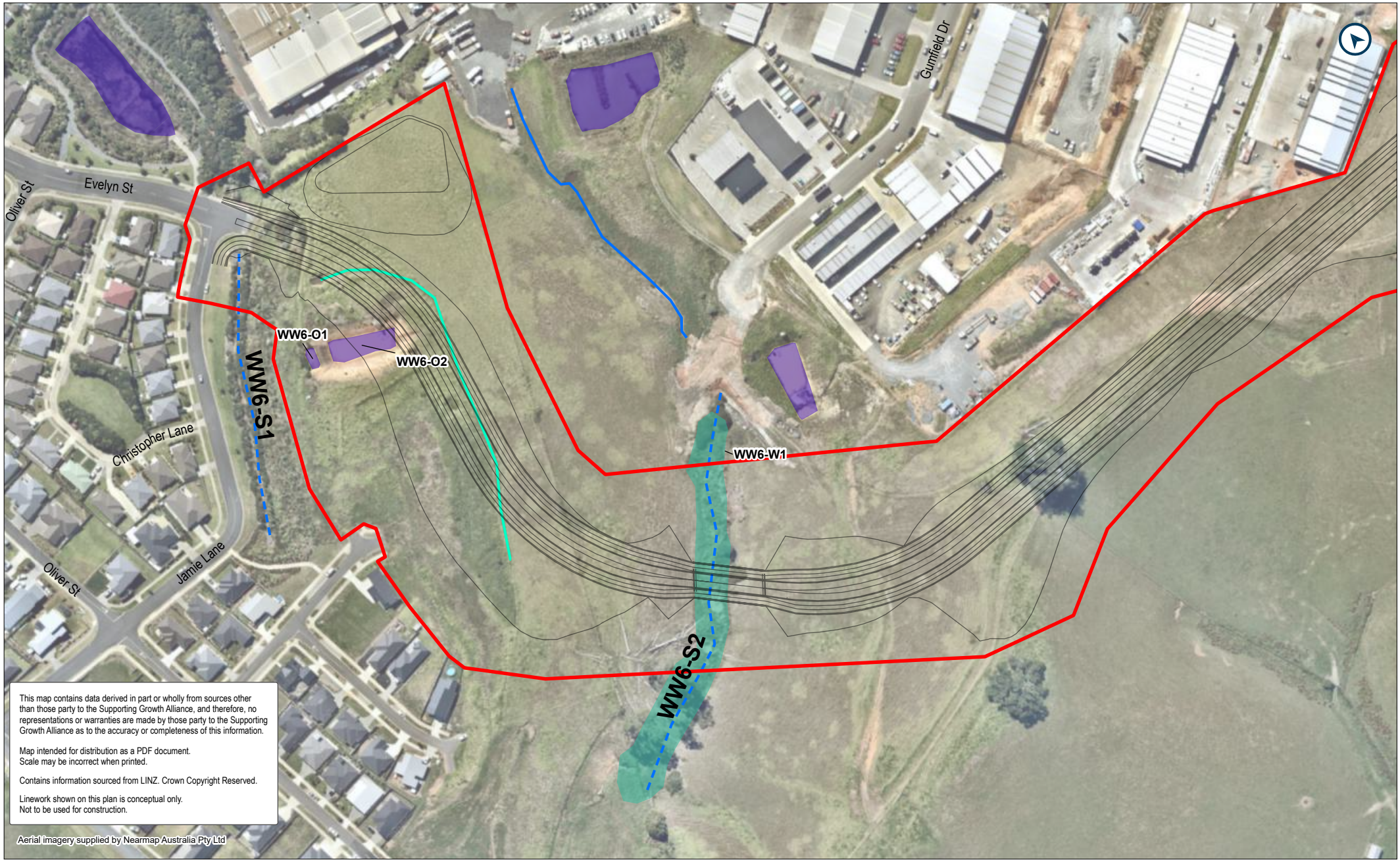
ASSESSMENT OF ECOLOGICAL EFFECTS
PART 4 OF 5

LEGEND

Route Option
Designation

Habitat mapping
ES
PL.1
PL.3
TL
TL.3

0 50 100
Metres



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LEGEND

- Route Option
- Designation
- Stream classification
  - Artificial ditch
  - swale/drainage
  - Intermittent
  - Permanent
- Habitat mapping
  - OW
  - WL19

0 50 100
Metres

Name of Map: SGA-EC-WW-032-Habitat-mapping-streams-and-wetlands-WS

Path: \\Beca.net\projects\38\138109\34\TG\101 Maps\06 ArcGIS Pro\01 Warkworth\SGA_Warkworth_Ecology_Figures.aprx

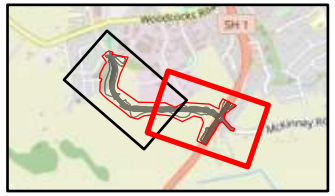
LEGEND

Route Option

Designation

Habitat mapping

EW



0 50 100

Metres

5.7 NOR 7: Sandspit Link

5.7.1 Terrestrial Vegetation

Name of Map: SGA-EC-WW-027-Habitat-mapping-terrestrial-vegetation-SL

Path: \\Beca.net\projects\38\130934\TG\01 Maps\06 ArcGIS Pro\01 Warkworth\SGA_Warkworth_Ecology_Figures.aprx

LEGEND

Route Option
Designation

Habitat mapping
BF
PL.3
TL.1
TL.2
TL.3
WF11

0 50 100
Metres

Name of Map: SGA-EC-WW-027-Habitat-mapping-terrestrial-vegetation-SL

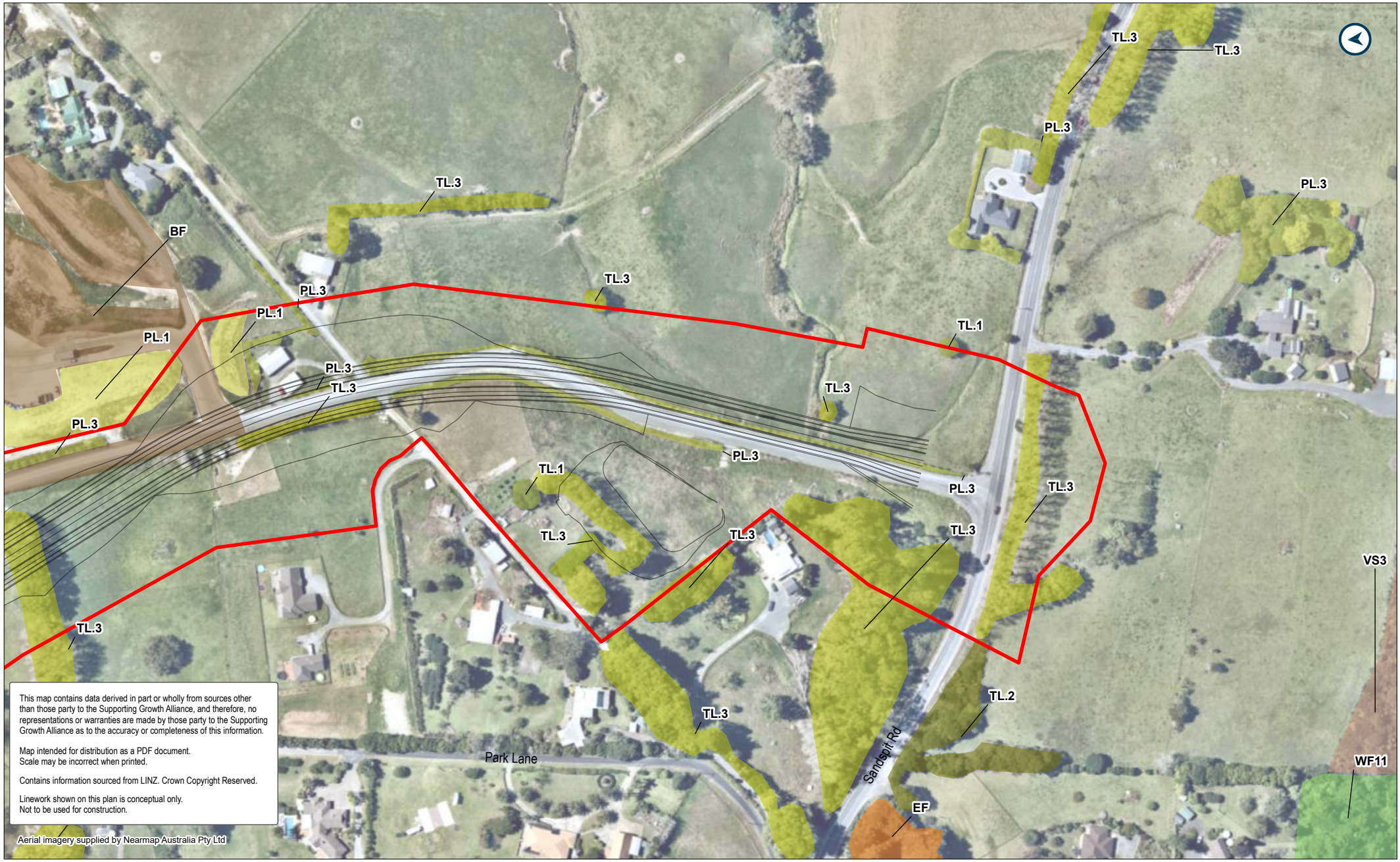
Path: \\Beca.net\projects\38\138109\34\TG\01 Maps\06 ArcGIS Pro\01 Warkworth\SGA_Warkworth_Ecology_Figures.aprx

LEGEND

Route Option
Designation

Habitat mapping
BF
EF
MF4
PL.1
PL.3
TL.1
TL.3
WF11
WF7.1

0 50 100
Metres



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LEGEND

Route Option
Designation

Habitat mapping
BF
EF
PL.1
PL.3
TL.1
TL.2
TL.3
VS3
WF11

0 50 100
Metres

5.7.2 Freshwater Streams and Wetland Habitat

Name of Map: SGA-EC-WW-036-Habitat-mapping-streams-and-wetlands-SL
Path: \\Beca.net\projects\381\38109341\TG\101 Maps\06 ArcGIS Pro\01 Warkworth\SGA_Warkworth_Ecology_Figures.aprx

LEGEND

Route Option
Designation

Stream classification
Artificial ditch
swale/drainage
Intermittent
Permanent

Habitat mapping
EW
OW

0 50 100
Metres

Name of Map: SGA-EC-WW-036-Habitat-mapping-streams-and-wetlands-SL

Path: \\Beca.net\projects\38\138109\34\TG\01 Maps\06 ArcGIS Pro\01 Warkworth\SGA_Warkworth_Ecology_Figures.aprx

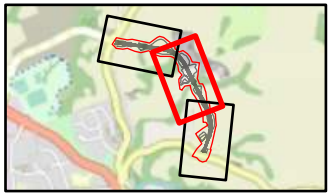
LEGEND

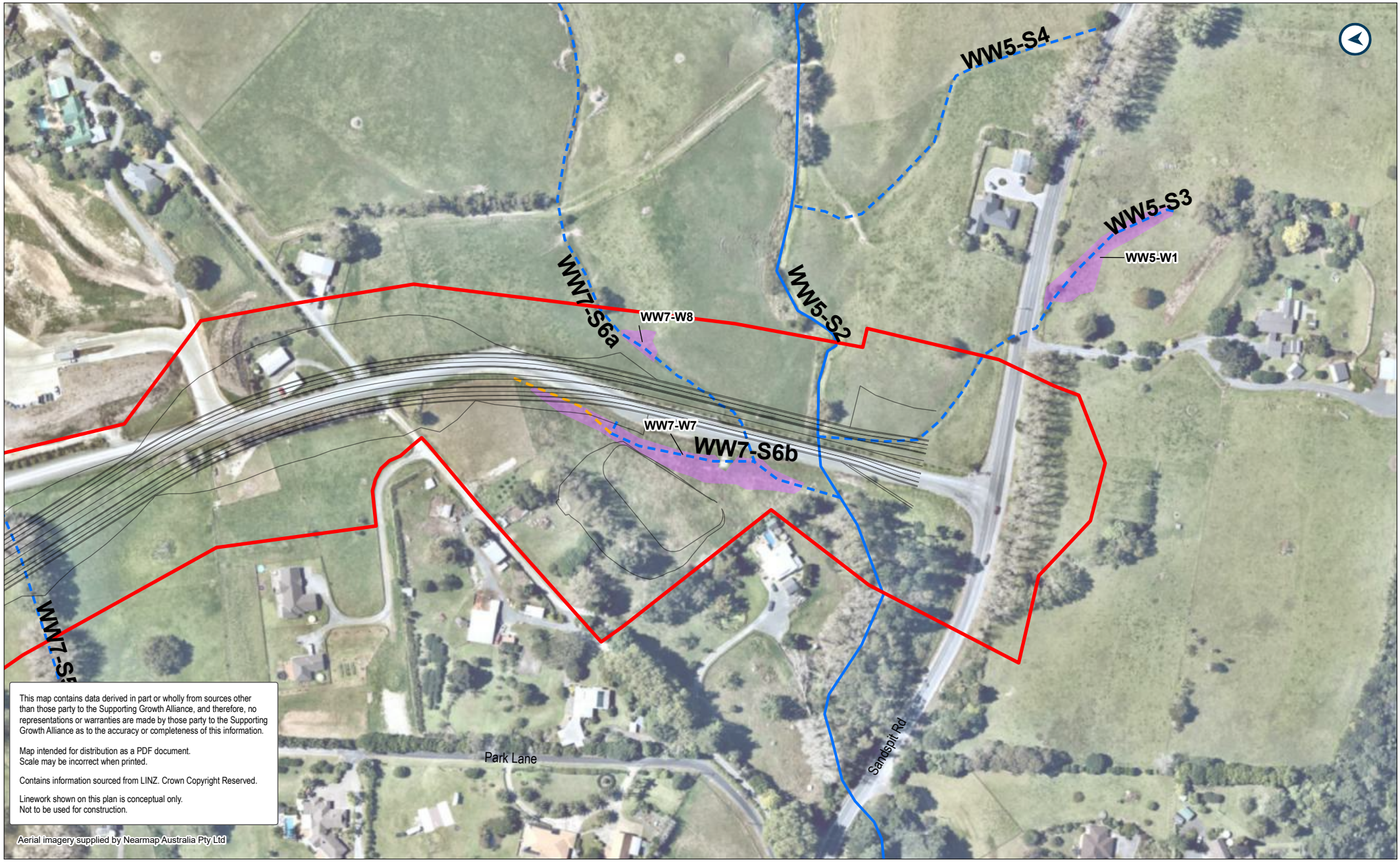
Route Option
Designation

Stream classification
Intermittent
Permanent

Habitat mapping
EW
OW

0 50 100
Metres





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LEGEND

Route Option
Designation

Stream classification
Ephemeral
Intermittent
Permanent

Habitat mapping
EW

0 50 100
Metres

5.8 NOR 8: Wider Western Link (North)

5.8.1 Terrestrial Vegetation

Name of Map: SGA-EC-WW-025-Habitat-mapping-terrestrial-vegetation-WW

Path: \\Beca.net\projects\381\38109304\TG\01 Maps\06 ArcGIS Pro\01 Warkworth\SGA_Warkworth_Ecology_Figures.aprx

LEGEND

Route Option
Designation

Habitat mapping
BF
PL.1
PL.2
PL.3
TL.3
WF11

0 30 60
Metres

575

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Path: \\Beca.net\projects\38\138109\34\TG\01 Map\06 ArcGIS Pro\01 Warkworth\SGA_Warkworth_Ecology_Figures.aprx

LEGEND

Route Option

Designation

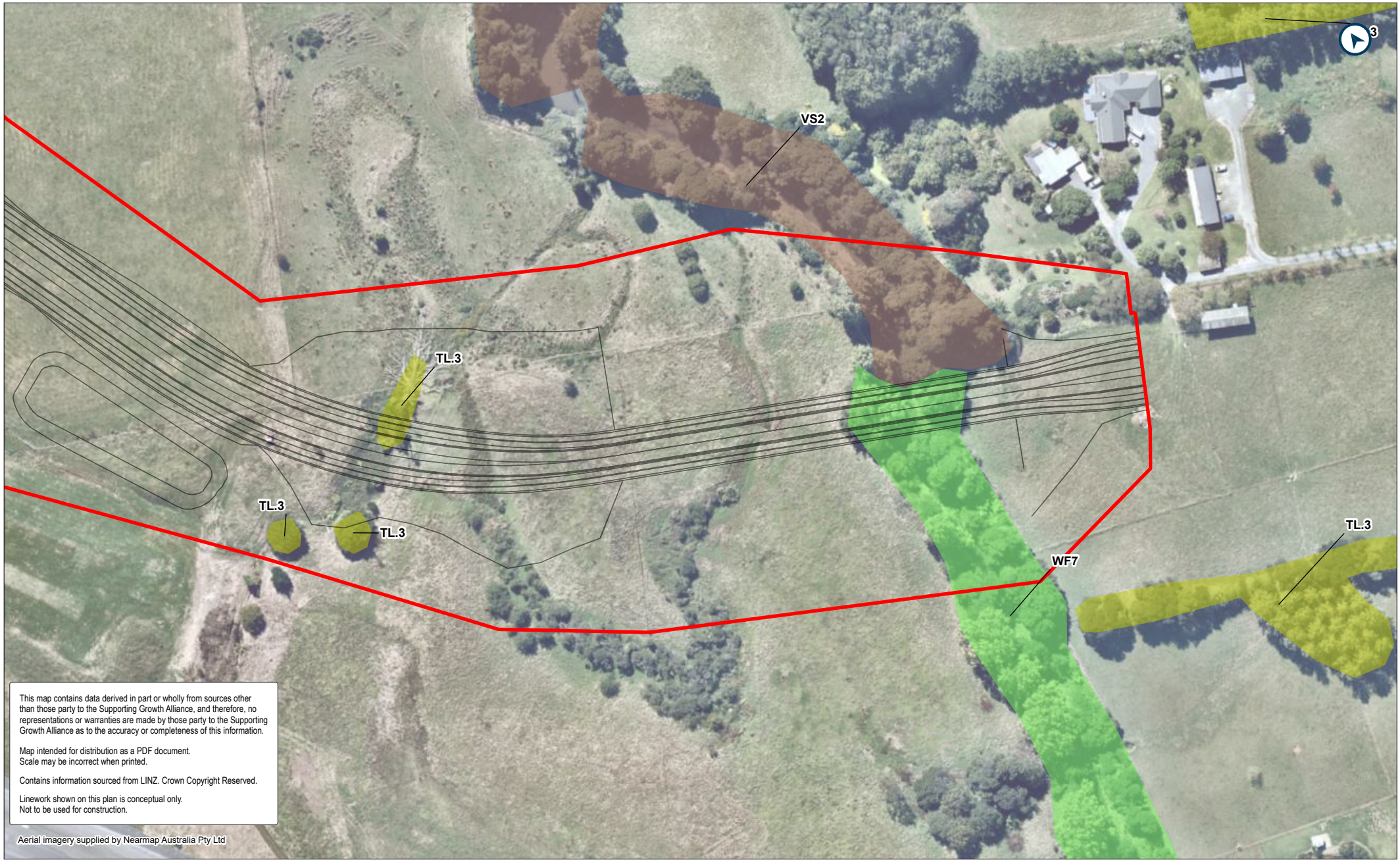
Habitat mapping

BF

TL.3

0 30 60

Metres



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LEGEND

- Route Option
- Designation

Habitat mapping

- TL.3
- VS2
- WF7

0 30 60
Metres

Name of Map: SGA-EC-WW-025-Habitat-mapping-terrestrial-vegetation-WW

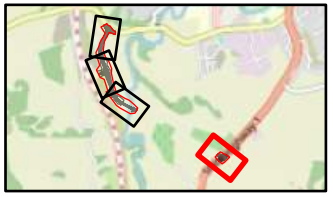
Path: \\Beca.net\projects\38\138109\34\TG\01 Maps\06 ArcGIS Pro\01 Warkworth\SGA_Warkworth_Ecology_Figures.aprx

LEGEND

Route Option
Designation

Habitat mapping
PL.1
PL.3
TL.3

0 30 60
Metres



5.8.2 Freshwater Streams and Wetland Habitat

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Path: \\Beca.net\projects\381\38109\34\TG\101 Map\06 ArcGIS Pro\01 Warkworth\SGA_Warkworth_Ecology_Figures.aprx

LEGEND

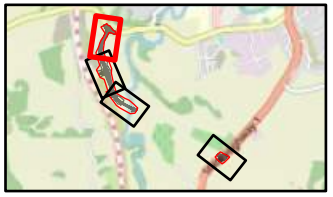
Route Option

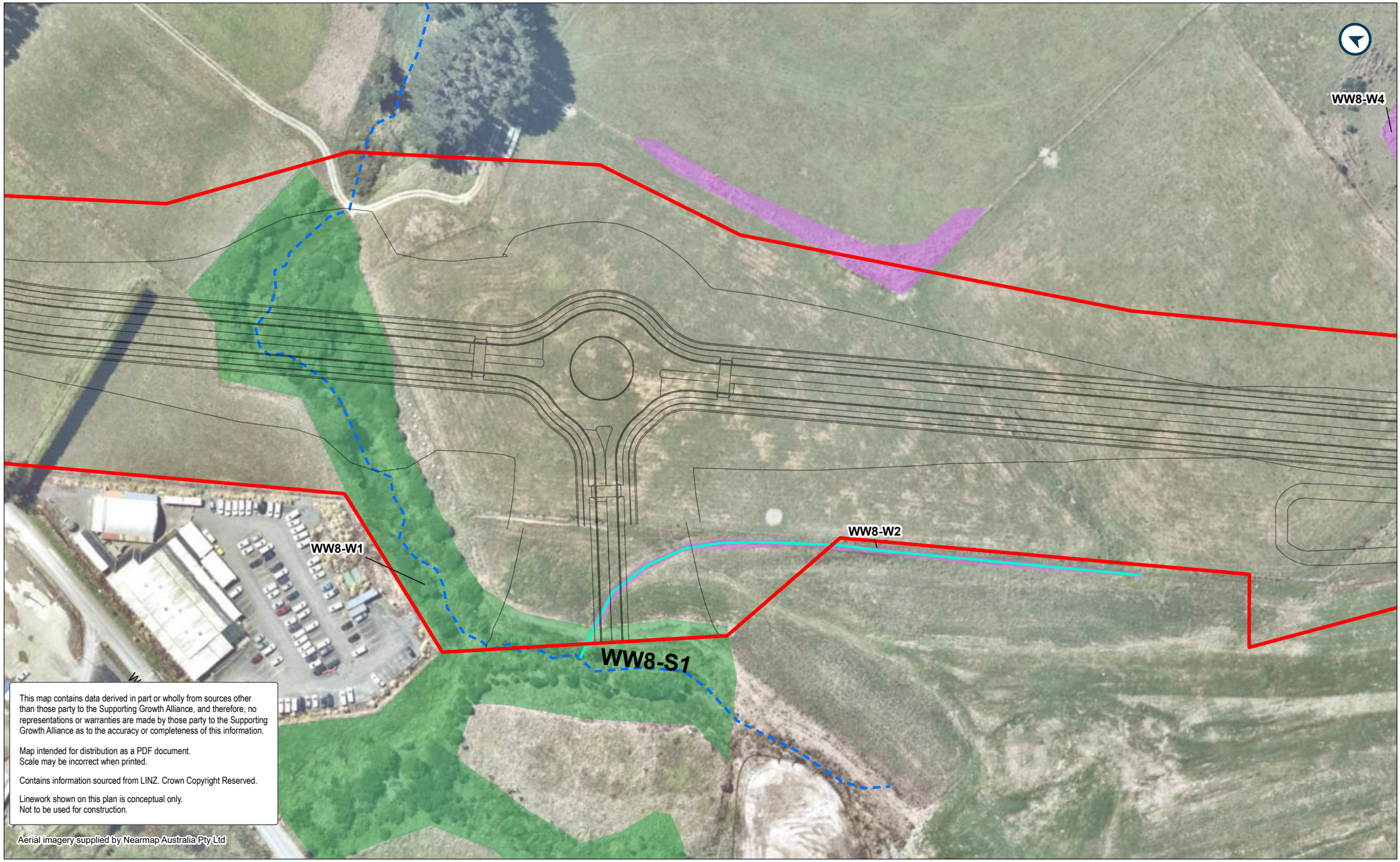
Designation

Stream classification
Permanent

Habitat mapping
EW
OW

0 30 60
Metres





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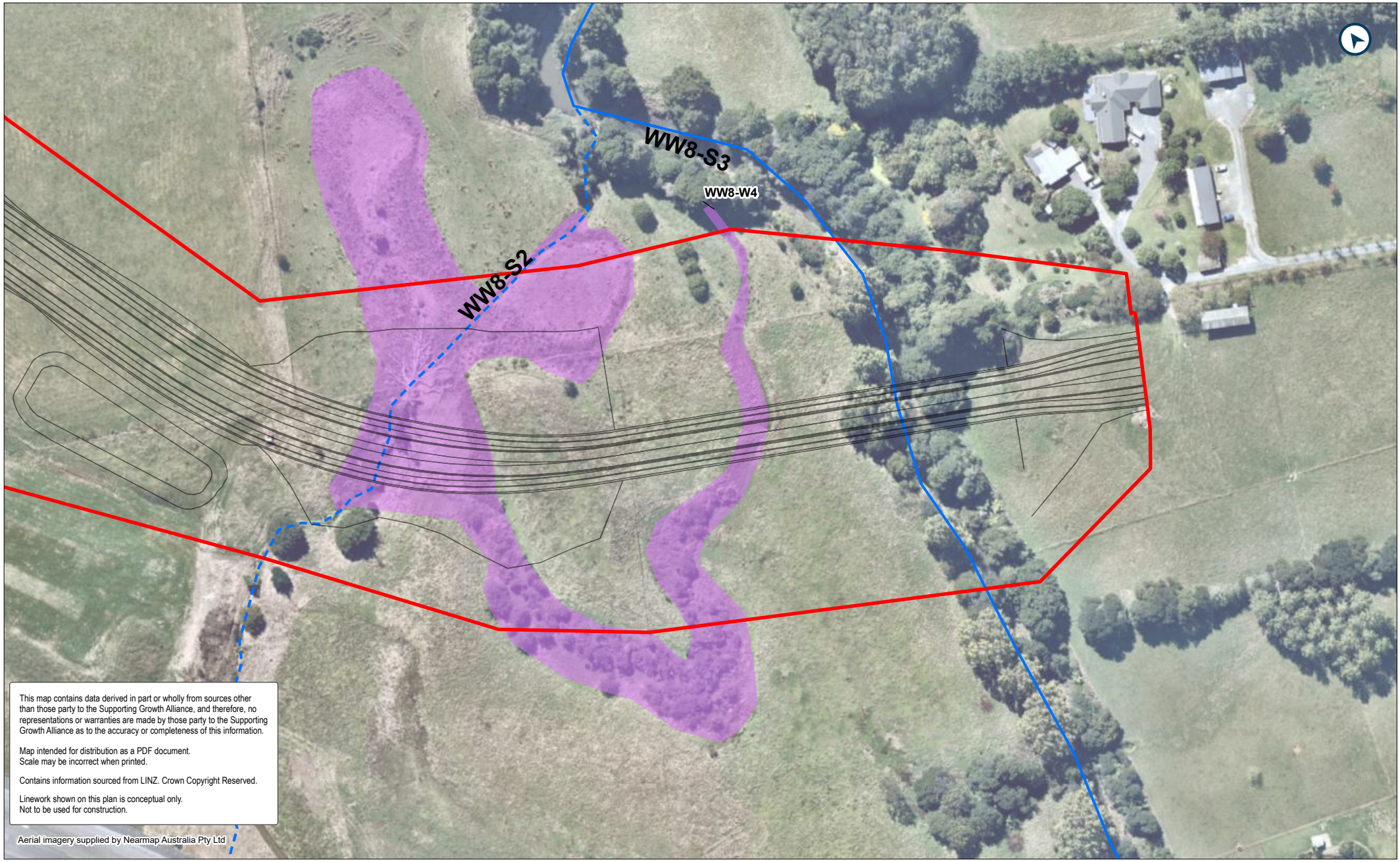
Path: \\Beca.net\projects\38\138109\94\TG\01 Map\06 ArcGIS Pro\01 Warkworth\SGA_Warkworth_Ecology_Figures.aprx

LEGEND

- Route Option
- Designation
- Stream classification
  - Artificial ditch
  - swale/drainage
  - Intermittent
- Habitat mapping
  - EW
  - PLW

0 30 60
Metres



Name of Map: SGA-EC-WW-034-Habitat-mapping-streams-and-wetlands-WW

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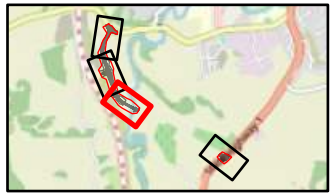
LEGEND

- Route Option
- Designation
- Stream classification
  - Intermittent
  - Permanent
- Habitat mapping
  - EW

0 30 60
Metres



582

Name of Map: SGA-EC-WW-034-Habitat-mapping-streams-and-wetlands-WW

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LEGEND

Route Option

Designation

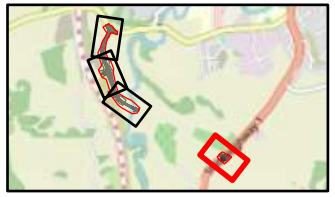
Stream classification

Artificial/Piped/Culvert

Permanent

0 30 60

Metres



6 Appendix 6 – Terrestrial Value Assessment

6.1 NOR 1: Northern Public Transport Interchange and Park & Ride, and Western Link - North (Northern Section)

Table 18-10 Assessment of ecological value for terrestrial ecology features for NOR 1

Attributes to be considered	1 - BF	1 - EG	1 - ES	Justification
Representativeness	**1**	**1**	**2**	
Typical structure and composition	1	1	1	BF, EG, ES: Habitats have been significantly altered by human activities (exotic dominated).
Indigenous representation	1	1	2	BF, EG: <10% of the species are indigenous. ES: 10-50% of the species are indigenous.
Rarity/distinctiveness	**0**	**3**	**3**	
Species of conservation significance	-	3	3	Copper skink (At Risk - Declining, value score 3) likely to utilise suitable habitat within the Project Area (EG, ES). New Zealand pipit (At Risk - Declining) likely to utilise EG for foraging and nesting. Non-TAR native birds (value score of 2) likely to utilise all suitable habitat (EG, ES).
Distinctive ecological values	-	-	-	Habitats not playing an important role in provisional or regulatory ecosystem services at any scale.
Diversity and pattern	**1**	**1**	**1**	
Habitat diversity	1	1	1	Low diversity of vegetation and geomorphological structure and low patchiness/interspersion (uniformity).
Species diversity	1	1	1	Species diversity not significant at any scale.

Attributes to be considered	1 - BF	1 - EG	1 - ES	Justification
Patterns in habitat use	1	1	1	All habitats are not important for lifecycle completion or periodic habitat utilisation on any scale.
Ecological context	**0**	**0**	**1**	
Size, shape and buffering	-	-	1	ES provides some buffering function to permanent stream WW1-S2.
Sensitivity to change	-	-	-	All habitats are generally modified with no residual sensitive receptors.
Ecological networks (linkages, pathways, migration)	-	-	-	All habitats are not important in terms of connectivity for the survival of any species at any scale.
Combined value	**N**	**L**	**L**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

6.2 NOR 2: Woodcocks Road Upgrade (Western Section)

Table 18-11 Assessment of ecological value for terrestrial ecology features for NOR 2

Attributes to be considered	2 - BF	2 - EG	2 - ES	2 - PL.1	2 - PL.2	2 - PL.3	2 - TL.2	2 - TL.3	2 - WF11	Justification
Representativeness	**1**	**1**	**2**	**4**	**4**	**2**	**3**	**2**	**4**	
Typical structure and composition	1	1	1	2	2	1	3	1	4	BF, EG, ES, PL.3, TL.3: Habitats have been significantly altered by human activities (exotic dominated). PL.1, PL.2: Habitat and species have been affected by human activities. TL.2, WF11: Habitat has been insignificantly affected by human activities (WF11 scored higher as it is native forest cover).
Indigenous representation	1	1	2	4	4	2	3	2	4	BF, EG: <10% of the species are indigenous. ES, PL.3, TL.3: 10-50% of the species are indigenous. TL.2: 50-90% of the species are indigenous. PL.1, PL.2, WF11: >90% of the species are indigenous.
Rarity/distinctiveness	**0**	**3**	**2**	**3**	**3**	**2**	**4**	**4**	**4**	
Species of conservation significance	-	3	2	3	3	2	4	4	4	Long-tailed bat (Threatened – Nationally Critical, value score of 4) present and potentially using suitable habitat (TL.2, TL.3, WF11). TAR bird species including New Zealand pipit (At Risk - Declining, value score of 3), North Island kākā (At Risk - Recovering, value score of 3), long-tailed cuckoo (Threatened - Nationally Vulnerable, value score of 4) expected to utilise suitable habitat (EG for pipit, and TL.2, WF11 for kākā and long-tailed cuckoo). Copper skink and ornate skink (At Risk - Declining, value score 3) likely to utilise suitable habitat (all habitat types excluding BF). Elegant gecko (At Risk - Declining, value score of 3), forest gecko (At Risk - Declining, value score of 3), and pacific gecko (Not Threatened

Attributes to be considered	2 - BF	2 - EG	2 - ES	2 - PL.1	2 - PL.2	2 - PL.3	2 - TL.2	2 - TL.3	2 - WF11	Justification
										nationally, however considered Regionally Declining (Melzer et al., 2022) in the Auckland region, therefore given a Moderate ecological value), likely to utilise suitable habitat (TL.2, WF11). ES and PL.3 scored lower due to small habitat extent and location on the roadside.
Distinctive ecological values	-	-	-	-	-	-	-	-	3	WF11: Habitat playing an important role in provisional or regulatory ecosystem services typically on Regional scale (native forest cover). All other habitats not playing an important role in provisional or regulatory ecosystem services at any scale.
Diversity and pattern	**1**	**1**	**1**	**1**	**1**	**1**	**3**	**2**	**4**	
Habitat diversity	1	1	1	1	1	1	3	1	3	TL.2, WF11: Very High diversity of vegetation and geomorphological structure and Moderate patchiness interspersion. All other habitats have a Low diversity of vegetation and geomorphological structure and low patchiness/interspersion (uniformity).
Species diversity	1	1	1	1	1	1	3	1	4	Increased species diversity in areas with indigenous species present and late succession: TL.2, WF11. WF11 rated higher due to higher % indigenous species.
Patterns in habitat use	1	1	1	1	1	1	3	2	3	TL.2, TL.3, WF11 rated high due to potential seasonal utilisation by long-tailed bat, North Island kākā, and long-tailed cuckoo. TL.3 scored lower as it mostly provides stepping stone habitat for these species. All other habitats are not important for lifecycle completion or periodic habitat utilisation on any scale.
Ecological context	**0**	**0**	**0**	**1**	**0**	**0**	**3**	**2**	**3**	

Attributes to be considered	2 - BF	2 - EG	2 - ES	2 - PL.1	2 - PL.2	2 - PL.3	2 - TL.2	2 - TL.3	2 - WF11	Justification
Size, shape and buffering	-	-	-	1	-	-	2	-	3	Large extent of WF11 provides buffering to permanent stream WW2-S1 and part of WW2-S2. Limited extent of TL.2 provides some buffering to permanent stream WW2-S3. Small extent of PL.1 provides some buffering to permanent stream WW2-S2. All other habitat is represented by small and isolated patches of habitat.
Sensitivity to change	-	-	-	-	-	-	2	-	3	TL.2, WF11: Intact habitat and late succession. WF11: Regional IUCN threat status is Endangered. All other habitats are generally modified with no residual sensitive receptors.
Ecological networks (linkages, pathways, migration)	-	-	-	-	-	-	3	2	3	Aged woody structure (TL.2, WF11) increase stepping stone value (connecting other areas of ecological value) for long-tailed bats and other terrestrial TAR native bird species. TL.3 scored lower as the habitat is mostly restricted to shelterbelt planting. All other habitat is not important in terms of connectivity for the survival of any species at any scale.
Combined value	**N**	**L**	**L**	**M**	**L**	**L**	**H**	**M**	**H**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

6.3 NOR 3: State Highway 1 Upgrade (Southern Section)

Table 18-12 Assessment of ecological value for terrestrial ecology features for NOR 3

Attributes to be considered	3 - BF	3 - EG	3 - ES	3 - PL.1	3 - PL.2	3 - PL.3	3 - TL.1	3 - TL.2	3 - TL.3	3 - VS2	Justification
Representativeness	**1**	**1**	**2**	**4**	**4**	**2**	**4**	**3**	**2**	**4**	
Typical structure and composition	1	1	1	2	2	1	2	3	2	3	BF, EG, ES, PL.3: Habitats have been significantly altered by human activities (exotic dominated). PL.1, PL.2, TL.1, TL.3: Habitat and species have been affected by human activities. TL.1 has been included as it is limited to a handful of native trees along the SH1 that have likely been planted. TL.2, VS2: Habitat has been insignificantly affected by human activities.
Indigenous representation	1	1	2	4	4	2	4	3	2	4	BF, EG: <10% of the species are indigenous. ES, PL.3, TL.3: 10-50% of the species are indigenous. TL.2: 50-90% of the species are indigenous. PL.1, PL.2, TL.1, VS2: >90% of the species are indigenous.
Rarity/distinctiveness	**0**	**3**	**2**	**3**	**2**	**2**	**2**	**3**	**3**	**3**	
Species of conservation significance	-	3	2	3	2	2	2	3	3	3	Long-tailed bat (Threatened – Nationally Critical, value score of 4) present and potentially using suitable habitat (TL.1, TL.2, TL.3). As this habitat is restricted to patches of treeland along the existing State Highway 1, a score of 3 has been assigned. TAR bird species including New Zealand pipit (At Risk - Declining, value score of 3) expected to be utilise suitable habitat (EG). Copper skink (At Risk - Declining, value score 3) likely to utilise suitable habitat (all habitat types excluding BF).

Attributes to be considered	3 - BF	3 - EG	3 - ES	3 - PL.1	3 - PL.2	3 - PL.3	3 - TL.1	3 - TL.2	3 - TL.3	3 - VS2	Justification
											ES, PL.2, PL.3, TL.1 scored lower due to small habitat extent and location on the roadside.
Distinctive ecological values	-	-	-	-	-	-	-	-	-	1	VS2: Native forest cover, however the habitat is small in extent and isolated. All other habitats not playing an important role in provisional or regulatory ecosystem services at any scale.
Diversity and pattern	**1**	**1**	**1**	**1**	**1**	**1**	**3**	**3**	**3**	**1**	
Habitat diversity	1	1	1	1	1	1	1	1	1	1	Increased habitat diversity in areas with indigenous species present and late succession: TL.1, TL.2, TL.3., however these are limited in extent in NOR 3 and mostly restricted to shelterbelt planting, therefore have scored low. All other habitats have a Low diversity of vegetation and geomorphological structure and low patchiness/interspersion (uniformity).
Species diversity	1	1	1	1	1	1	1	1	1	1	Species diversity not significant at any scale.
Patterns in habitat use	1	1	1	1	1	1	3	3	3	1	TL.1, TL.2, and TL.3 rated high due to potential seasonal utilisation by long-tailed bat. All other habitats are not important for lifecycle completion or periodic habitat utilisation on any scale.
Ecological context	**0**	**1**	**1**	**1**	**1**	**1**	**3**	**3**	**3**	**1**	
Size, shape and buffering	-	-	-	1	-	-	-	-	1	-	Permanent streams in the NOR buffered by limited extent of TL.3. An intermittent stream (no ID), south of BP station, is buffered by approx. 3,362 m^2 area of PL.1. All other areas of PL.1 are small in extent and located on the roadside.

Attributes to be considered	3 - BF	3 - EG	3 - ES	3 - PL.1	3 - PL.2	3 - PL.3	3 - TL.1	3 - TL.2	3 - TL.3	3 - VS2	Justification
											All other habitat is represented by small and isolated patches of habitat.
Sensitivity to change	-	-	-	-	-	-	-	-	-	-	All habitat is either exotic-dominated with no sensitive receptors or is represented by small and isolated patches of habitat.
Ecological networks (linkages, pathways, migration)	-	1	1	1	1	1	3	3	3	1	All habitats (excluding BF) are locally an important breeding and feeding link in terms of connectivity for the survival of species (e.g. native birds). Aged woody structure (TL.1, TL.2, and TL.3) increase stepping stone value (connecting other areas of ecological value) for long-tailed bats.
Combined value	**N**	**L**	**L**	**M**	**L**	**L**	**M**	**M**	**M**	**M**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

6.4 NOR 4: Matakana Road Upgrade

Table 18-13 Assessment of ecological value for terrestrial ecology features for NOR 4

Attributes to be considered	4 - BF	4 - EG	4 - MF4	4 - PL.1	4 - PL.2	4 - PL.3	4 - TL.1	4 - TL.2	4 - TL.3	4 - VS2	4 – WF 13	Justification
Representativeness	**1**	**1**	**4**	**4**	**4**	**2**	**4**	**3**	**2**	**4**	**4**	
Typical structure and composition	1	1	4	2	2	1	2	2	2	4	4	BF, EG, PL.3: Habitats have been significantly altered by human activities (exotic dominated). PL.1, PL.2, TL.1, TL.2, TL.3: Habitat and species have been affected by human activities. TL.2 included due to its restricted extent and development either side. TL.1 included as it is restricted to a few isolated trees. MF4, VS2, WF13: Habitat has been insignificantly affected by human activities.
Indigenous representation	1	1	4	4	4	2	4	3	2	4	4	BF, EG: <10% of the species are indigenous. PL.3, TL.3: 10-50% of the species are indigenous. TL.2: 50-90% of the species are indigenous. MF4, PL.1, PL.2 TL.1, VS2, WF13: >90% of the species are indigenous.
Rarity/distinctiveness	**0**	**3**	**4**	**2**	**3**	**3**	**2**	**4**	**4**	**3**	**4**	
Species of conservation significance	-	3	4	2	3	3	2	4	4	3	4	Long-tailed bat (Threatened – Nationally Critical, value score of 4) present and potentially using suitable habitat (MF4, TL.1, TL.2, TL.3, WF13). TL.1 not scored as high as it is restricted to isolated native trees in NOR 4. TAR bird species including New Zealand pipit (At Risk - Declining, value score of 3), North Island kākā (At Risk - Recovering, value score of 3), long-tailed cuckoo (Threatened - Nationally Vulnerable, value score of 4) expected to utilise suitable habitat (EG for pipit, and MF4,

Attributes to be considered	4 - BF	4 - EG	4 - MF4	4 - PL.1	4 - PL.2	4 - PL.3	4 - TL.1	4 - TL.2	4 - TL.3	4 - VS2	4 – WF 13	Justification
												TL.1, TL.2, TL.3, WF13 for kākā and long-tailed cuckoo). Copper skink and ornate skink (At Risk - Declining, value score 3) likely to utilise suitable habitat (all habitat types excluding BF). Elegant gecko (At Risk - Declining, value score of 3), forest gecko (At Risk - Declining, value score of 3), and pacific gecko (Not Threatened nationally, however considered Regionally Declining (Melzer et al., 2022) in the Auckland region, therefore given a Moderate ecological value), likely to utilise suitable habitat (MF4, TL.1, TL.2, WF13). PL.1 scored lower due to small habitat extent and location along roadside. TL.1 scored lower as it is restricted to a few isolated trees.
Distinctive ecological values	-	-	3	-	-	-	-	-	-	2	3	MF4, VS2, WF13: Habitat playing an important role in provisional or regulatory ecosystem services typically on Regional scale (native forest cover). VS2 scored lower due to smaller extent and existing fragmentation. All other habitats not playing an important role in provisional or regulatory ecosystem services at any scale.
Diversity and pattern	**1**	**1**	**4**	**1**	**1**	**1**	**1**	**2**	**2**	**3**	**4**	
Habitat diversity	1	1	4	1	1	1	1	1	1	2	4	MF4, VS2, WF13: Very High diversity of vegetation and geomorphological structure and Moderate patchiness interspersion. VS2 scored lower due to small extent and existing fragmentation. All other habitats have a Low diversity of vegetation and

Attributes to be considered	4 - BF	4 - EG	4 - MF4	4 - PL.1	4 - PL.2	4 - PL.3	4 - TL.1	4 - TL.2	4 - TL.3	4 - VS2	4 – WF 13	Justification
												geomorphological structure and low patchiness/interspersion (uniformity).
Species diversity	1	1	4	1	1	1	1	2	1	3	4	Increased species diversity in areas with indigenous species present and late succession: TL.2, MF4, VS2, WF13 Species diversity not significant at any scale for all other habitats.
Patterns in habitat use	1	1	3	1	1	1	1	2	2	2	3	MF4, TL.1, TL.2, TL.3, VS2, WF13 rated high due to potential seasonal utilisation by long-tailed bat, North Island kākā, and long-tailed cuckoo. TL.1 rated lower as it is restricted to a few isolated trees. All other habitats are not important for lifecycle completion or periodic habitat utilisation on any scale.
Ecological context	**0**	**0**	**3**	**0**	**0**	**0**	**1**	**2**	**2**	**2**	**4**	
Size, shape and buffering	-	-	2	-	-	-	-	-	-	-	3	Large extent of MF4, and WF13 provides buffering to permanent stream WW5-S1. All other habitat is represented by small and isolated patches of habitat.
Sensitivity to change	-	-	3	-	-	-	-	-	-	2	3	MF4, VS2, WF13: Intact habitat and late succession. MF4: Regional IUCN threat status is Critically Endangered. All other habitats are generally modified with no residual sensitive receptors.
Ecological networks (linkages, pathways, migration)	-	-	3	-	-	-	1	2	2	1	4	Aged woody structure (MF4, TL.1, TL.2, TL.3, VS2 and WF13) increase stepping stone value (connecting other areas of ecological value) for long-tailed bats and other

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Attributes to be considered	4 - BF	4 - EG	4 - MF4	4 - PL.1	4 - PL.2	4 - PL.3	4 - TL.1	4 - TL.2	4 - TL.3	4 - VS2	4 – WF 13	Justification
												terrestrial TAR native bird species. Arboreal geckos anticipated to use areas of MF4, VS2, and WF13. TL.1 scored lower as it is restricted to a few isolated trees. VS2 scored lower as it is fragmented between Matakana Road and Sandspit Road, but could be used as a stepping stone between the SEAs to the west, north, and east of this habitat. Area of WF13 is also designated as a Significant Ecological Area (SEA_T_2260). All other habitat is not important in terms of connectivity for the survival of any species at any scale.
Combined value	**N**	**L**	**H**	**L**	**L**	**L**	**L**	**M**	**M**	**M**	**VH**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

6.5 NOR 5: Sandspit Road Upgrade

Table 18-14 Assessment of ecological value for terrestrial ecology features for NOR 5

Attributes to be considered	5 - BF	5 - EF	5 - EG	5 - ES	5 - MF4	5 - PL. 1	5 - PL. 3	5 - TL. 2	5 - TL. 3	5 - VS2	5 - WF 11	5- WF 7.1	Justification
Representativeness	**1**	**2**	**1**	**2**	**4**	**4**	**2**	**3**	**2**	**4**	**4**	**4**	
Typical structure and composition	1	1	1	1	3	2	1	2	1	3	4	4	BF, EF, EG, ES, PL.3, TL.3: Habitats have been significantly altered by human activities (exotic dominated). PL.1, TL.2: Habitat and species have been affected by human activities. TL.2 included due to its restricted extent and development either side. PL.1 included as it is restricted to a few isolated trees.

Attributes to be considered	5 - BF	5 - EF	5 - EG	5 - ES	5 - MF4	5 - PL. 1	5 - PL. 3	5 - TL. 2	5 - TL. 3	5 - VS2	5 - WF 11	5- WF 7.1	Justification
													MF4, VS2, WF11: Habitat has been insignificantly affected by human activities.
Indigenous representation	1	2	1	2	4	4	2	3	2	4	4	4	BF, EG: <10% of the species are indigenous. ES, EF, PL.3, TL.3: 10-50% of the species are indigenous. TL.2: 50-90% of the species are indigenous. MF4, PL.1, VS2, WF11, WF7.1: >90% of the species are indigenous.
Rarity/distinctiveness	**0**	**4**	**3**	**3**	**4**	**2**	**2**	**4**	**4**	**4**	**4**	**4**	
Species of conservation significance	-	4	3	3	4	2	2	4	4	4	4	4	Long-tailed bat (Threatened – Nationally Critical, value score of 4) present and potentially using suitable habitat (EF, MF4, TL.2, TL.3, VS2, WF11). TAR bird species including New Zealand pipit (At Risk - Declining, value score of 3), North Island kākā (At Risk - Recovering, value score of 3), long-tailed cuckoo (Threatened - Nationally Vulnerable, value score of 4) expected to utilise suitable habitat (EG for pipit, and EF, MF4, TL.2, TL.3, VS2, WF11 for kākā and long-tailed cuckoo). Copper skink and ornate skink (At Risk - Declining, value score 3) likely to utilise suitable habitat (all habitat types with appropriate understorey excluding BF). Elegant gecko (At Risk - Declining, value score of 3), forest gecko (At Risk - Declining, value score of 3), and pacific gecko (Not Threatened nationally, however considered Regionally Declining (Melzer et al., 2022) in the Auckland region, therefore given a Moderate ecological value), likely to utilise suitable habitat (MF4, TL.1, TL.2, WF11).

Attributes to be considered	5 - BF	5 - EF	5 - EG	5 - ES	5 - MF4	5 - PL. 1	5 - PL. 3	5 - TL. 2	5 - TL. 3	5 - VS2	5 - WF 11	5- WF 7.1	Justification
													PL.1 and PL.3 scored lower due to small habitat extent and location along roadside/residential gardens.
Distinctive ecological values	-	-	-	-	3	-	-	-	-	2	3	3	MF4, VS2, WF11: Habitat playing an important role in provisional or regulatory ecosystem services typically on Regional scale (native forest cover). VS2 scored lower due to smaller extent and existing fragmentation. All other habitats not playing an important role in provisional or regulatory ecosystem services at any scale.
Diversity and pattern	**1**	**3**	**1**	**1**	**3**	**1**	**1**	**3**	**3**	**3**	**4**	**4**	
Habitat diversity	1	1	1	1	2	1	1	1	1	2	4	4	Increased habitat diversity in areas with indigenous species present and in areas with late succession. WF11, WF7.1: Very High diversity of vegetation and geomorphological structure and Moderate patchiness interspersion.
Species diversity	1	1	1	1	2	1	1	1	1	2	3	3	Increased species diversity in areas with indigenous species present and in areas with late succession: WF11
Patterns in habitat use	1	3	1	1	3	1	1	3	3	3	3	3	EF, MF4, TL.1, TL.2, TL.3, VS2, WF11 rated high due to potential seasonal utilisation by long-tailed bat, North Island kākā, and long-tailed cuckoo. All other habitats are not important for lifecycle completion or periodic habitat utilisation on any scale.
Ecological context	**0**	**3**	**0**	**0**	**3**	**0**	**0**	**3**	**2**	**2**	**2**	**4**	
Size, shape and buffering	-	2	-	-	3	-	-	3	-	-	2	2	Large extent of TL.2, and provides buffering to permanent stream WW5-S1. Large extent of MF4, provides buffering to WW5-S1 and WW5-

Attributes to be considered	5 - BF	5 - EF	5 - EG	5 - ES	5 - MF4	5 - PL. 1	5 - PL. 3	5 - TL. 2	5 - TL. 3	5 - VS2	5 - WF 11	5- WF 7.1	Justification
													S2. Moderate extent of EF also provides buffering to WW5-S2. Moderate extent of WF11 provides some buffering function to MF4 habitat. All other habitat is represented by small and isolated patches of habitat.
Sensitivity to change	-	-	-	-	3	-	-	-	-	2	2	2	MF4, VS2, WF11, WF7.1: Intact habitat and late succession. MF4: Regional IUCN threat status is Critically Endangered. All other habitats are generally modified with no residual sensitive receptors.
Ecological networks (linkages, pathways, migration)	-	3	-	-	3	-	-	3	2	2	2	4	Aged woody structure (EF, MF4, TL.2, TL.3, VS2, and WF11) increase stepping stone value (connecting other areas of ecological value) for long-tailed bats and other terrestrial TAR native bird species. Arboreal geckos anticipated to use areas of MF4, VS2, and WF11. VS2 scored lower as it is fragmented between Matakana Road and Sandspit Road, but could be used as a stepping stone between the SEAs to the west, north, and east of this habitat. Area of WF11 south of Matakana Road is also designated as a Significant Ecological Area. WF11 relatively small and isolated. WF7.1 provided ecological connection to upslope and downslope forested areas (including SNAs) All other habitats are not important in terms of connectivity for the survival of any species at any scale.
Combined value	**N**	**M**	**L**	**L**	**H**	**L**	**L**	**H**	**M**	**H**	**H**	**VH**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

6.6 NOR 6: New Western Link - South

Table 18-15 Assessment of ecological value for terrestrial ecology features for NOR 6

Attributes to be considered	6 - BF	6 - EG	6 - ES	6 - PL.1	6 - TL.3	Justification
Representativeness	**1**	**1**	**2**	**4**	**2**	
Typical structure and composition	1	1	1	2	2	BF, EG, ES: Habitats have been significantly altered by human activities (exotic dominated). PL.1, TL.3: Habitat and species have been affected by human activities.
Indigenous representation	1	1	2	4	2	BF, EG: <10% of the species are indigenous. ES, TL.3: 10-50% of the species are indigenous. PL.1: >90% of the species are indigenous.
Rarity/distinctiveness	**0**	**3**	**2**	**3**	**4**	
Species of conservation significance	-	3	2	3	4	Long-tailed bat (Threatened – Nationally Critical, value score of 4) present and potentially using suitable habitat (TL.3). TAR bird species including New Zealand pipit (At Risk - Declining, value score of 3) expected to utilise suitable habitat (EG). Copper skink (At Risk - Declining, value score 3) likely to utilise suitable habitat (all habitat types excluding BF). ES rated lower due to small extent that is isolated and located adjacent to the road.
Distinctive ecological values	-	-	-	-	-	All habitats not playing an important role in provisional or regulatory ecosystem services at any scale.
Diversity and pattern	**1**	**1**	**1**	**1**	**1**	
Habitat diversity	1	1	1	1	1	Low diversity of vegetation and geomorphological structure and low patchiness/interspersion (uniformity).
Species diversity	1	1	1	1	1	Species diversity not significant at any scale.

Attributes to be considered	6 - BF	6 - EG	6 - ES	6 - PL.1	6 - TL.3	Justification
Patterns in habitat use	1	1	1	1	1	All habitats are not important for lifecycle completion or periodic habitat utilisation on any scale.
Ecological context	**0**	**0**	**0**	**1**	**0**	
Size, shape and buffering	-	-	-	1	-	PL.1 provides limited buffering to intermittent streams WW6-S1 and WW6-S2. All other habitats are represented by small and isolated patches of habitat.
Sensitivity to change	-	-	-	-	-	All habitats are generally modified with no residual sensitive receptors.
Ecological networks (linkages, pathways, migration)	-	-	-	-	-	All habitats in the context of NOR 6 are not considered important in terms of connectivity for the survival of any species at any scale.
Combined value	**N**	**L**	**L**	**M**	**L**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

6.7 NOR 7: Sandspit Link

Table 18-16 Assessment of ecological value for terrestrial ecology features for NOR 7

Attributes to be considered	7 - BF	7 - EG	7 - MF4	7 - PL.1	7 - PL.3	7 - TL.1	7 - TL.3	7 – WF 11	7 – WF 7.1	Justification
Representativeness	**1**	**1**	**4**	**4**	**2**	**4**	**2**	**4**	**4**	
Typical structure and composition	1	1	4	2	1	3	2	3	2	BF, EG, PL.3: Habitats have been significantly altered by human activities (exotic dominated). PL.1, TL.3: Habitat and species have been affected by human activities. TL.1, MF4: Habitat has been insignificantly affected by human activities (MF4 scored higher as it is native forest cover). WF11: Totara dominated, no or little understory, modified remnant forest W7.1: modified and remnant
Indigenous representation	1	1	4	4	2	4	2	4	4	BF, EG: <10% of the species are indigenous. PL.3, TL.3: 10-50% of the species are indigenous. MF4, PL.1, TL.1, WF11, WF7.1: >90% of the species are indigenous.
Rarity/distinctiveness	**0**	**3**	**4**	**2**	**2**	**2**	**4**	**4**	**4**	
Species of conservation significance	-	3	4	2	2	2	4	4	4	Long-tailed bat (Threatened – Nationally Critical, value score of 4) present and potentially using suitable habitat (MF4, TL.1, TL.3, WF11, WF7.1). TAR bird species including New Zealand pipit (At Risk - Declining, value score of 3), North Island kākā (At Risk - Recovering, value score of 3), long-tailed cuckoo (Threatened - Nationally Vulnerable, value score of 4) expected to utilise suitable habitat (EG for pipit, and MF4, PL.1, TL.1, WF11 for kākā and long-tailed cuckoo). Copper skink and ornate skink (At Risk - Declining, value score 3) likely to utilise suitable habitat (all habitat types excluding BF).

Attributes to be considered	7 - BF	7 - EG	7 - MF4	7 - PL.1	7 - PL.3	7 - TL.1	7 - TL.3	7 – WF 11	7 – WF 7.1	Justification
										Elegant gecko (At Risk - Declining, value score of 3), forest gecko (At Risk - Declining, value score of 3), and pacific gecko (Not Threatened nationally, however considered Regionally Declining (Melzer et al., 2022) in the Auckland region, therefore given a Moderate ecological value), likely to utilise suitable habitat (MF4, PL.1, TL.1, WF11). PL.1 and PL.3 scored lower due to small habitat extent/early growth. TL.1 scored lower as the habitat is restricted to a few trees adjacent to wetland WW7-W3.
Distinctive ecological values	-	-	3	-	-	-	-	3	3	MF4, WF11, WF7.1: Habitat playing an important role in provisional or regulatory ecosystem services typically on Regional scale (native forest cover). All other habitats not playing an important role in provisional or regulatory ecosystem services at any scale.
Diversity and pattern	**1**	**1**	**3**	**1**	**1**	**2**	**2**	**4**	**3**	
Habitat diversity	1	1	3	1	1	2	2	4	3	MF4, WF11, WF7.1: Very High diversity of vegetation and geomorphological structure and Moderate patchiness interspersion. TL.1 and TL.3 scored lower as restricted to stands or rows of a few trees. All other habitats have a Low diversity of vegetation and geomorphological structure and low patchiness/interspersion (uniformity).
Species diversity	1	1	3	1	1	1	1	4	3	Increased species diversity in areas with indigenous species present and late succession: MF4, WF11, WF7.1. MF4 scored slightly lower as the habitat is restricted to a buffer around stream WW7-S4. Species diversity not significant at any scale for all other habitats.
Patterns in habitat use	1	1	3	1	1	2	2	3	3	MF4, TL.1, TL.3, WF11, WF7.1 rated high due to potential seasonal utilisation by long-tailed bat, North Island kākā, and long-tailed cuckoo.

Attributes to be considered	7 - BF	7 - EG	7 - MF4	7 - PL.1	7 - PL.3	7 - TL.1	7 - TL.3	7 – WF 11	7 – WF 7.1	Justification
										TL.1 and TL.3 scored lower as restricted to stands or rows of a few trees. All other habitats are not important for lifecycle completion or periodic habitat utilisation on any scale.
Ecological context	**0**	**1**	**3**	**1**	**1**	**2**	**2**	**2**	**2**	
Size, shape and buffering	-	-	2	-	-	-	1	2	2	Large extent of WF11 provides buffering to numerous streams in the area. Relatively small extent of remnant WF11 left. MF4 provides buffering to WW7-S4. Small extent of TL.3 provides some buffering function to streams in the NOR. All other habitat is represented by small and isolated patches of habitat.
Sensitivity to change	-	-	3	-	-	-	-	2	2	MF4, WF11, WF7.1: Intact habitat and late succession. MF4: Regional IUCN threat status is Critically Endangered. WF11: Regional IUCN threat status is Endangered. All other habitats are generally modified with no residual sensitive receptors.
Ecological networks (linkages, pathways, migration)		1	3	1	1	2	2	2	2	All habitats (excluding BF) are locally an important breeding and feeding link in terms of connectivity for the survival of species (e.g. native birds). Aged woody structure (MF4, TL.1, TL.3, WF11) increase stepping stone value (connecting other areas of ecological value) for long-tailed bats and other terrestrial TAR native bird species. WF11, TL.1 and TL.3 scored lower due to limited extent.
Combined value	**N**	**L**	**H**	**L**	**L**	**M**	**M**	**H**	**H**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

6.8 NOR 8: Wider Western Link (North)

Table 18-17 Assessment of ecological value for terrestrial ecology features for NOR 8

Attributes to be considered	8 - BF	8 - EG	8 - PL.2	8 - PL.3	8 - TL.3	8 - VS2	8 - WF7	Justification
Representativeness	**1**	**1**	**4**	**2**	**2**	**4**	**4**	
Typical structure and composition	1	1	2	1	2	3	3	BF, EG, PL.3: Habitats have been significantly altered by human activities (exotic dominated). PL.2, TL.3: Habitat and species have been affected by human activities. VS2, WF7: Habitat has been insignificantly affected by human activities.
Indigenous representation	1	1	4	2	2	4	4	BF, EG: <10% of the species are indigenous. PL.3, TL.3: 10-50% of the species are indigenous. PL.2, VS2, WF7: >90% of the species are indigenous.
Rarity/distinctiveness	**0**	**3**	**2**	**2**	**4**	**4**	**4**	
Species of conservation significance	-	3	2	2	4	4	4	Long-tailed bat (Threatened – Nationally Critical, value score of 4) present and potentially using suitable habitat (TL.3, VS2, WF7). TAR bird species including New Zealand pipit (At Risk - Declining, value score of 3), North Island kākā (At Risk - Recovering, value score of 3), long-tailed cuckoo (Threatened - Nationally Vulnerable, value score of 4) expected to utilise suitable habitat (EG for pipit, and VS2, WF7 for kākā and long-tailed cuckoo). Copper skink and ornate skink (At Risk - Declining, value score 3) likely to utilise suitable habitat (all habitat types excluding BF). Elegant gecko (At Risk - Declining, value score of 3), forest gecko (At Risk - Declining, value score of 3), and pacific gecko (Not Threatened nationally, however considered Regionally Declining (Melzer et al., 2022) in the Auckland region, therefore given a Moderate ecological value), likely to utilise suitable habitat (VS2, WF7).

Attributes to be considered	8 - BF	8 - EG	8 - PL.2	8 - PL.3	8 - TL.3	8 - VS2	8 - WF7	Justification
								PL.2 and PL.3 scored lower due to small extent of habitat and location along roadside.
Distinctive ecological values	-	-	-	-	-	3	3	VS2, WF7: Habitat playing an important role in provisional or regulatory ecosystem services typically on Regional scale (native forest cover). All other habitats not playing an important role in provisional or regulatory ecosystem services at any scale.
Diversity and pattern	**1**	**1**	**1**	**1**	**1**	**3**	**3**	
Habitat diversity	1	1	1	1	1	3	3	VS2, WF7: Very High diversity of vegetation and geomorphological structure and Moderate patchiness interspersion. All other habitats have a Low diversity of vegetation and geomorphological structure and low patchiness/interspersion (uniformity).
Species diversity	1	1	1	1	1	2	2	Increased species diversity in areas with indigenous species present and late succession: VS2, WF7. Species diversity not significant at any scale for all other habitats.
Patterns in habitat use	1	1	1	1	1	3	3	VS2 and WF7 rated high due to potential seasonal utilisation by long-tailed bat, North Island kākā, and long-tailed cuckoo. All other habitats are not important for lifecycle completion or periodic habitat utilisation on any scale.
Ecological context	**0**	**1**	**1**	**1**	**1**	**3**	**3**	
Size, shape and buffering	-	-	-	-	-	2	2	Both WF11 and VS2 provide a buffering function to permanent stream WW8-S3. All other habitats are represented by small and isolated patches.

Attributes to be considered	8 - BF	8 - EG	8 - PL.2	8 - PL.3	8 - TL.3	8 - VS2	8 - WF7	Justification
Sensitivity to change	-	-	-	-	-	2	3	VS2, WF7: Intact habitat and late succession. WF7: Regional IUCN threat status: Critically Endangered. All other habitats are generally modified with no residual sensitive receptors.
Ecological networks (linkages, pathways, migration)	-	1	1	1	1	3	3	All habitats (excluding BF) are locally an important breeding and feeding link in terms of connectivity for the survival of species (e.g. native birds). Aged woody structure (VS2, WF7) increases stepping stone value (connecting other areas of ecological value) for long-tailed bats and other terrestrial TAR native bird species.
Combined value	**N**	**L**	**L**	**L**	**L**	**H**	**H**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

7 Appendix 7 – Aquatic Value Assessment

7.1 NOR 1: Northern Public Transport Interchange and Park & Ride, and Western Link - North (Northern Section)

Table 18-18 Assessment of ecological value for aquatic ecology features for NOR 1

Attributes to be considered	WW1 -S1	WW1 -S2	Justification
Representativeness	**1**	**1**	
Riparian habitat modification	1	1	WW1-S1, WW1-S2 riparian features have been significantly altered by agricultural/horticultural activities (desktop assessment).
Rarity/distinctiveness	**1**	**3**	
Species of conservation significance	1	3	Īnanga (At Risk - Declining) and longfin eel (At Risk – Declining) has been recorded in the wider catchment associated with NOR 1 (Mahurangi River). There is a high likelihood that these species utilise permanent streams (WW1-S2). WW1-S1 recently modified due to construction (unrelated to the Project). Common native species were identified via desktop in wider catchment.
Diversity and pattern	**2**	**2**	
Level of natural diversity	2	2	WW1-S1 desktop proxy: M, P, LO, LG, 3 = 2 WW1-S2 desktop proxy: SS, P, LO, LG, 4 = 2
Ecological context	**4**	**4**	
Stream order	2	3	Order 1 streams = WW1-S1 Order 2 streams = WW1-S2

Attributes to be considered	WW1 -S1	WW1 -S2	Justification
Hydroperiod	4	4	Permanent streams = WW1-S1, WW1-S2
Combined value	**L**	**M**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

7.2 NOR 2: Woodcocks Road Upgrade (Western Section)

Table 18-19 Assessment of ecological value for aquatic ecology features for NOR 2

Attributes to be considered	WW2-S1	WW2-S2	WW2-S3	WW2-S4	Justification
Representativeness	**3**	**2**	**3**	**1**	
Riparian habitat modification	3	2	3	1	RHA total score is 70-90% relative to reference = WW2-S1, WW2-S3 RHA total score is 40-70% relative to reference = WW2-S2 All other RHA total scores are <40%.
Rarity/distinctiveness	**3**	**3**	**3**	**2**	
Species of conservation significance	3	3	3	2	Īnanga (At Risk Declining) and longfin eel (At Risk – Declining) has been recorded in the wider catchment associated with NOR 2 (value score of 3). Longfin eel (At Risk - Declining) and gambusia observed at WW2-S2. Common native species were identified via desktop in wider catchment. Fish habitat scores are 19/20 (WW2-S1), 13/20 (WW2-S2), 17/20 (WW2-S3), and 10/20 (WW2-S4).
Diversity and pattern	**4**	**3**	**3**	**2**	
Level of natural diversity	4	3	3	2	Instream RHA scores: WW2-S1 = 43 (4) WW2-S2 = 26 (3) WW2-S3 = 34 (3) WW2-S4 = 17 (2)
Ecological context	**4**	**4**	**4**	**3**	

Attributes to be considered	WW2-S1	WW2-S2	WW2-S3	WW2-S4	Justification
Stream order	4	3	4	1	Order 4 streams = WW2-S1, WW2-S3 Order 2 streams = WW2-S2 All other streams are zero order streams.
Hydroperiod	4	4	4	3	Intermittent streams = WW2-S4 Permanent streams = WW2-S1, WW2-S2, WW2-S3
Connectivity and migration	4	-	4	-	Riparian connectivity between SEAs in the wider landscape.
Combined value	**H**	**M**	**H**	**L**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

7.3 NOR 3: State Highway 1 Upgrade (Southern Section)

Table 18-20 Assessment of ecological value for aquatic ecology features for NOR 3

Attributes to be considered	WW3 -S1a	WW3 -S1b	WW3 -S1c	WW3 -S2a	WW3 -S2b	WW3 -S3a	WW3 -S3b	WW3 -S4a	WW3 -S4b	Justification
Representativeness	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**2**	**2**	
Riparian habitat modification	2	2	2	1	1	1	1	2	2	RHA total score is 40-70% relative to reference = WW3-S1a, WW3-S1b, WW3-S1c, WW3-S4a, WW3-S4b All other RHA total scores are <40%.
Rarity/distinctiveness	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	
Species of conservation significance	3	3	3	3	3	2	3	3	3	Longfin eel (At Risk – Declining) has been recorded in the wider catchment associated with NOR 3. Common native species were identified via desktop in wider catchment. Fish habitat: WW3-S1a = 11 (3) WW3-S1b = 13 (3) WW3-S1c = 11 (3) WW3-S2a = 11 (3) WW3-S2b = 11 (3) WW3-S3a = 7 (2) WW3-S3b = 11 (3) WW3-S4a = 13 (3) WW3-S4b = 15 (3)
Diversity and pattern	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	
Level of natural diversity	3	2	2	2	2	2	2	2	2	Instream RHA scores: WW3-S1a = 26 (3) WW3-S1b = 25 (2)

Attributes to be considered	WW3-S1a	WW3-S1b	WW3-S1c	WW3-S2a	WW3-S2b	WW3-S3a	WW3-S3b	WW3-S4a	WW3-S4b	Justification
										WW3-S1c = 17 (2) WW3-S2a = 21 (2) WW3-S2b = 21 (2) WW3-S3a = 13.5 (2) WW3-S3b = 17 (2) WW3-S4a = 22 (2) WW3-S4b = 21 (2)
Ecological context	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	
Stream order	3	3	1	2	2	1	1	2	1	Order 2 streams = WW3-S1a, WW3-S1b Order 1 streams = WW3-S2a, WW3-S2b, WW3-S4a All other streams are zero order streams.
Hydroperiod	4	4	4	4	4	4	4	4	4	All streams are permanent streams.
Combined value										

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

7.4 NOR 4: Matakana Road Upgrade

Table 18-21 Assessment of ecological value for aquatic ecology features for NOR 4

Attributes to be considered	WW4 -S1	WW4 -S2	WW4 -S3	Justification
Representativeness	**1**	**1**	**1**	
Riparian habitat modification	1	1	1	All RHA total scores are <40%.
Rarity/distinctiveness	**1**	**1**	**1**	
Species of conservation significance	1	1	1	Īnanga (At Risk - Declining) and longfin eel (At Risk – Declining) has been recorded in the wider catchment associated with NOR 4. However, fish cover diversity and abundance score very low in the RHA. Common native species were identified via desktop in wider catchment.
Diversity and pattern	**1**	**1**	**1**	
Level of natural diversity	1	1	1	Instream RHA scores: WW4-S1 = 5 (1) WW4-S2 = 5 (1) WW4-S3 = 5 (1)
Ecological context	**3**	**3**	**3**	
Stream order	1	1	1	All streams are zero order streams.
Hydroperiod	3	3	3	All streams are intermittent.
Combined value	**L**	**L**	**L**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

7.5 NOR 5: Sandspit Road Upgrade

Table 18-22 Assessment of ecological value for aquatic ecology features for NOR 5

Attributes to be considered	WW5-S1	WW5-S2	WW5-S3	WW5-S4	WW5-S5	WW5-S6	Justification
Representativeness	**3**	**2**	**1**	**1**	**1**	**2**	
Riparian habitat modification	3	2	1	1	1	2	RHA total score is 70-90% relative to reference = WW5-S1 RHA total score is 40-70% relative to reference = WW5-S2, WW5-S6 RHA total score is <40% relative to reference = WW5-S3, WW5-S4, WW5-S5
Rarity/distinctiveness	**3**	**3**	**1**	**2**	**1**	**2**	
Species of conservation significance	3	3	1	2	1	2	Īnanga (At Risk – Declining) and longfin eel (At Risk – Declining) has been recorded in the wider catchment associated with the Project Area (value score of 3). Hochstetter's frog (At Risk - Declining) potentially found in area. Fish habitat scores are: WW5-S1 =16/20 (3) WW5-S2 = 14/20 (3) WW5-S3 = 4/20 (1) WW5-S4 = 8/20 (2) WW5-S5 = 5/20 (1) WW5-S6 = 6/20 (2)
Diversity and pattern	**4**	**3**	**1**	**2**	**1**	**2**	
Level of natural diversity	4	3	1	2	1	2	Instream RHA scores: WW5-S1 = 43 (4) WW5-S2 = 30 (3) WW5-S3 = 8 (1) WW5-S4 = 14 (2) WW5-S5 = 12 (1) WW5-S6 = 18 (2)

Attributes to be considered	WW5-S1	WW5-S2	WW5-S3	WW5-S4	WW5-S5	WW5-S6	Justification
Ecological context	**4**	**4**	**3**	**3**	**3**	**3**	
Stream order	3	2	1	1	1	1	Order 2 stream = WW5-S1 Order 1 stream = WW5-S2 All other streams are zero order.
Hydroperiod	4	4	3	3	3	3	Permanent streams = WW5-S1, WW5-S2 All other streams are intermittent.
Combined value	**H**	**M**	**L**	**L**	**L**	**M**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

7.6 NOR 6: New Western Link - South

Table 18-23 Assessment of ecological value for aquatic ecology features for NOR 6

Attributes to be considered	WW6-S1	WW6-S2	Justification
Representativeness	**2**	**2**	
Riparian habitat modification	2	2	RHA total score is 40-70% relative to reference = WW6-S1, WW6-S2
Rarity/distinctiveness	**2**	**2**	
Species of conservation significance	2	2	Īnanga (At Risk – Declining) and longfin eel (At Risk – Declining) has been recorded in the wider catchment associated with the Project Area (value score of 3). However, fish habitat scores are 7/20 (WW6-S2) and 9/20 (WW6-S2), therefore this category has been given a value score of 2.
Diversity and pattern	**2**	**2**	
Level of natural diversity	2	2	Instream RHA scores: WW6-S1 = 16 (2) WW6-S2 = 15 (2)
Ecological context	**3**	**3**	
Stream order	1	1	Zero order streams = WW6-S1, WW6-S2
Hydroperiod	3	3	Intermittent streams = WW6-S1, WW6-S2
Combined value	**M**	**M**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

7.7 NOR 7: Sandspit Link

Table 18-24 Assessment of ecological value for aquatic ecology features for NOR 7

Attributes to be considered	WW7-S1	WW7-S2a	WW7-S2b	WW7-S3a	WW7-S3b	WW7-S4	WW7-S5	WW7-S6a	WW7-S6b	Justification
Representativeness	**1**	**2**	**1**	**2**	**1**	**3**	**1**	**1**	**1**	
Riparian habitat modification	1	2	1	2	1	3	1	1	1	RHA total score is 70-90% relative to reference = WW7-S4 RHA total score is 40-70% relative to reference = WW7-S2a, WW7-S3a All other RHA total scores are <40%.
Rarity/distinctiveness	**2**	**2**	**1**	**2**	**1**	**3**	**1**	**2**	**1**	
Species of conservation significance	2	2	1	2	1	3	1	2	1	Īnanga (At Risk - Declining) and longfin eel (At Risk – Declining) has been recorded in the wider catchment associated with NOR 7. Hochstetter's frog (At Risk - Declining) potentially found in WW7-S4 Common native species were identified via desktop in wider catchment.
Diversity and pattern	**2**	**2**	**1**	**2**	**1**	**4**	**1**	**2**	**1**	
Level of natural diversity	2	2	1	2	1	4	1	2	1	Instream RHA scores: WW7-S1 = 13 (2) WW7-S2a = 19 (2) WW7-S2b = 8.5 (1) WW7-S3a = 17 (2) WW7-S3b = 9 (1) WW7-S4 = 45 (4) WW7-S5 = 8 (1) WW7-S6a = 16 (2) WW7-S6b = 8 (1)
Ecological context	**3**	**4**	**3**	**4**	**3**	**4**	**3**	**3**	**3**	

Attributes to be considered	WW7-S1	WW7-S2a	WW7-S2b	WW7-S3a	WW7-S3b	WW7-S4	WW7-S5	WW7-S6a	WW7-S6b	Justification
Stream order	1	1	1	1	1	3	1	1	1	Order 2 streams = WW7-S4 All other streams are zero order streams.
Hydroperiod	3	4	3	4	3	4	3	3	3	Permanent streams = WW7-S2a, WW7-S3a, WW7-S4 All other streams are intermittent.
Combined value	**L**	**M**	**L**	**M**	**L**	**H**	**L**	**L**	**L**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

7.8 NOR 8: Wider Western Link (North)

Table 18-25 Assessment of ecological value for aquatic ecology features for NOR 8

Attributes to be considered	WW8-S1	WW8-S2	WW8-S3	Justification
Representativeness	**2**	**2**	**3**	
Riparian habitat modification	2	2	3	RHA total score is 40-70% relative to reference = WW8-S1, WW8-S3 WW8-S3: Riparian features have been insignificantly affected by human activities (although surrounded by horticultural/agricultural activities, riparian margin remains relatively unchanged).
Rarity/distinctiveness	**2**	**2**	**3**	
Species of conservation significance	2	2	3	Longfin eel (At Risk – Declining) has been recorded in the wider catchment associated with NOR 8. Common native species were identified via desktop in wider catchment. High quality fish habitat is likely present at WW8-S3. Good quality fish habitat is present at WW8-S2 and WW8-S1.
Diversity and pattern	**2**	**2**	**3**	
Level of natural diversity	2	2	3	Instream RHA scores: WW8-S1 = 2 WW8-S2 = 2 WW8-S3 = 3 (Desktop)
Ecological context	**3**	**3**	**4**	
Stream order	1	1	4	Order 4 streams = WW8-S3 All other streams are zero order streams.

Attributes to be considered	WW8-S1	WW8-S2	WW8-S3	Justification
Hydroperiod	3	3	4	Intermittent streams = WW8-S1, WW8-S2 Permanent streams = WW8-S3
Connectivity and migration	-	-	4	Ecological connectivity in the wider landscape
Combined value	**M**	**M**	**H**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

8 Appendix 8 – Wetland Value Assessment

8.1 NOR 1: Northern Public Transport Interchange and Park & Ride, and Western Link - North (Northern Section)

Table 18-26 Assessment of ecological value for wetland ecology features for NOR 1

Attributes to be considered	WW1 -W1	WW1 -W2	Justification
Representativeness	**2**	**1**	
Hydrological modification	2	1	Scoring considered abstraction (including the presence and extent of exotic trees with high evapotranspiration rates), regulation by impoundments, drains or increased runoff from agricultural land or urban development.
Rarity/distinctiveness	**3**	**2**	
Species of conservation significance	3	2	Australasian bittern (Threatened – Nationally Critical, value score of 4) and spotless crake (At Risk - Declining, value score of 3) likely utilising large (> 5000 m2) wetlands that are present in the NOR (WW1-W1). Australasian bittern likely to only forage in this habitat, not nest, therefore a score of 3 has been assigned. Non-TAR native species (value score of 2) expected to utilise all wetlands in the NOR.
Vegetation type of conservation significance	1	1	Exotic dominated vegetation.
Diversity and pattern	**3**	**1**	
Diversity of habitat types	3	1	Scores reflect differences in the representation of different habitats associated with the period of inundation and or saturation. For example, for small wetlands (< 100 m2) that provide only temporary (<3 months/yr.) saturation was scored lower while larger wetlands (> 500 m2) with permanent, seasonal and temporary habitat scored higher.
Ecological context	**3**	**1**	

Attributes to be considered	WW1 -W1	WW1 -W2	Justification
Flood attenuation	3	1	Scores reflect differences in wetland size in relation to its catchment (a wetland size that is >10% of its catchment was scored higher). Additional consideration was given to the way in which stormflows are spread across the wetland. Other factors considered are surface roughness, slope, size of flood benches and sinuosity.
Streamflow augmentation	2	1	Scores reflect differences in the size and representation of different hydroperiods for each wetland. Wetlands with > 50% permanent saturation/inundation and that are directly connected to a downslope stream were scored higher. A temporary isolated wetland (such as a small seep) scored lower.
Sediment trapping	2	1	Scores reflect differences in estimated likely sediment yields from the catchments of each wetland (highest for steep catchments with no vegetation cover) against the ability of each wetland to trap sediment. Wetlands with diffuse flow patterns have high capacity to trap sediment and so scored higher while wetlands with strongly channelled flows and drains scored lower. Scoring also considered how frequently stormflows move through the wetland (>1 in 5 years likely to score lower, while >1 per year score higher).
Water purification	3	1	Scores consider sources of contamination in the wetland's catchment (agrichemicals, urban runoff etc) and the wetland's capacity to treat water (size relative to catchment and hydrological modification). As an example, a pasture wetland that is >10% of catchment and which retains hydrological integrity scored higher, while a very small wetland that was <1% of its catchment and modified scored lower.
Connectivity and migration	2	1	Scores reflect differences in the position of wetlands within the larger stream networks.
Combined value	**M**	**L**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

8.2 NOR 2: Woodcocks Road Upgrade (Western Section)

Table 18-27 Assessment of ecological value for wetland ecology features for NOR 2

Attributes to be considered	WW2-W1	WW2-W2	Justification
Representativeness	**1**	**1**	
Hydrological modification	1	1	Scoring considered abstraction (including the presence and extent of exotic trees with high evapotranspiration rates), regulation by impoundments, drains or increased runoff from agricultural land or urban development.
Rarity/distinctiveness	**2**	**2**	
Species of conservation significance	2	2	Non-TAR native species (value score of 2) expected to utilise all wetlands in the NOR.
Vegetation type of conservation significance	1	1	Exotic dominated vegetation.
Diversity and pattern	**2**	**1**	
Diversity of habitat types	2	1	Scores reflect differences in the representation of different habitats associated with the period of inundation and or saturation. For example, for small wetlands (< 100 m2) that provide only temporary (<3 months/yr.) saturation was scored lower while larger wetlands (> 500 m2) with permanent, seasonal and temporary habitat scored higher.
Ecological context	**2**	**1**	
Flood attenuation	1	1	Scores reflect differences in wetland size in relation to its catchment (a wetland size that is >10% of its catchment was scored higher). Additional consideration was given to the way in which stormflows are spread across the wetland. Other factors considered are surface roughness, slope, size of flood benches and sinuosity.
Streamflow augmentation	1	1	Scores reflect differences in the size and representation of different hydroperiods for each wetland. Wetlands with > 50% permanent saturation/inundation and that are directly connected to a downslope stream were scored higher. A temporary isolated wetland (such as a small seep) scored lower.

Attributes to be considered	WW2-W1	WW2-W2	Justification
Sediment trapping	1	1	Scores reflect differences in estimated likely sediment yields from the catchments of each wetland (highest for steep catchments with no vegetation cover) against the ability of each wetland to trap sediment. Wetlands with diffuse flow patterns have high capacity to trap sediment and so scored higher while wetlands with strongly channelled flows and drains scored lower. Scoring also considered how frequently stormflows move through the wetland (>1 in 5 years likely to score lower, while >1 per year score higher).
Water purification	2	1	Scores consider sources of contamination in the wetland's catchment (agrichemicals, urban runoff etc) and the wetland's capacity to treat water (size relative to catchment and hydrological modification). As an example, a pasture wetland that is >10% of catchment and which retains hydrological integrity scored higher, while a very small wetland that was <1% of its catchment and modified scored lower.
Connectivity and migration	1	1	Scores reflect differences in the position of wetlands within the larger stream networks.
Combined value	**L**	**L**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

8.3 NOR 3: State Highway 1 Upgrade (Southern Section)

Table 18-28 Assessment of ecological value for wetland ecology features for NOR 3

Attributes to be considered	WW3-W1	WW3-W2	WW3-W3	WW3-W4	WW3-W5	Justification
Representativeness	**1**	**1**	**1**	**2**	**1**	
Hydrological modification	1	1	1	2	1	Scoring considered abstraction (including the presence and extent of exotic trees with high evapotranspiration rates), regulation by impoundments, drains or increased runoff from agricultural land or urban development.
Rarity/distinctiveness	**3**	**2**	**3**	**3**	**3**	
Species of conservation significance	3	2	3	3	3	Australasian bittern (Threatened – Nationally Critical, value score of 4) and spotless crake (At Risk - Declining, value score of 3) potential to be utilising moderately sized wetlands (> 1000 m2) in the NOR (WW3-W1, WW3-W3, WW3-W4, WW3-W5). Australasian bittern likely to only forage in this habitat, not nest, therefore a score of 3 has been assigned. Non-TAR native species (value score of 2) expected to utilise all wetlands in the NOR.
Vegetation type of conservation significance	1	1	1	1	1	Exotic dominated vegetation.
Diversity and pattern	**2**	**1**	**2**	**2**	**1**	
Diversity of habitat types	2	1	2	2	1	Scores reflect differences in the representation of different habitats associated with the period of inundation and or saturation. For example, for small wetlands (< 100 m2) that provide only temporary (<3 months/yr.) saturation was scored lower while larger wetlands (> 500 m2) with permanent, seasonal and temporary habitat scored higher.
Ecological context	**3**	**1**	**3**	**3**	**3**	
Flood attenuation	2	1	2	2	2	Scores reflect differences in wetland size in relation to its catchment (a wetland size that is >10% of its catchment was scored higher). Additional consideration was given to the way in which stormflows

Attributes to be considered	WW3-W1	WW3-W2	WW3-W3	WW3-W4	WW3-W5	Justification
						are spread across the wetland. Other factors considered are surface roughness, slope, size of flood benches and sinuosity.
Streamflow augmentation	1	1	1	1	1	Scores reflect differences in the size and representation of different hydroperiods for each wetland. Wetlands with > 50% permanent saturation/inundation and that are directly connected to a downslope stream were scored higher. A temporary isolated wetland (such as a small seep) scored lower.
Sediment trapping	1	1	2	1	2	Scores reflect differences in estimated likely sediment yields from the catchments of each wetland (highest for steep catchments with no vegetation cover) against the ability of each wetland to trap sediment. Wetlands with diffuse flow patterns have high capacity to trap sediment and so scored higher while wetlands with strongly channelled flows and drains scored lower. Scoring also considered how frequently stormflows move through the wetland (>1 in 5 years likely to score lower, while >1 per year score higher).
Water purification	3	1	3	3	3	Scores consider sources of contamination in the wetland's catchment (agrichemicals, urban runoff etc) and the wetland's capacity to treat water (size relative to catchment and hydrological modification). As an example, a pasture wetland that is >10% of catchment and which retains hydrological integrity scored higher, while a very small wetland that was <1% of its catchment and modified scored lower.
Connectivity and migration	1	1	1	1	1	Scores reflect differences in the position of wetlands within the larger stream networks.
Combined value	**M**	**L**	**M**	**M**	**L**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

8.4 NOR 4: Matakana Road Upgrade

Table 18-29 Assessment of ecological value for wetland ecology features for NOR 4

Attributes to be considered	WW4 -W1	WW4 -W2	WW4 -W3	Justification
Representativeness	**2**	**2**	**2**	
Hydrological modification	2	2	2	Scoring considered abstraction (including the presence and extent of exotic trees with high evapotranspiration rates), regulation by impoundments, drains or increased runoff from agricultural land or urban development.
Rarity/distinctiveness	**3**	**3**	**2**	
Species of conservation significance	3	3	2	Australasian bittern (Threatened – Nationally Critical, value score of 4) and spotless crake (At Risk - Declining, value score of 3). Potential to utilise moderate to large sized wetlands (> 1000 m2) in the NOR (WW4-W1, WW4-W2) for foraging (unlikely to be nesting in this habitat). Australasian bittern likely to only forage in this habitat, not nest, therefore a score of 3 has been assigned. Non-TAR native species (value score of 2) expected to utilise all wetlands in the NOR.
Vegetation type of conservation significance	1	1	1	Exotic dominated vegetation.
Diversity and pattern	**2**	**2**	**1**	
Diversity of habitat types	2	2	1	Scores reflect differences in the representation of different habitats associated with the period of inundation and or saturation. For example, for small wetlands (< 100 m2) that provide only temporary (<3 months/yr.) saturation was scored lower while larger wetlands (> 500 m2) with permanent, seasonal and temporary habitat scored higher.
Ecological context	**3**	**3**	**1**	
Flood attenuation	2	2	1	Scores reflect differences in wetland size in relation to its catchment (a wetland size that is >10% of its catchment was scored higher). Additional consideration was given to the way in which stormflows are spread across the wetland. Other factors considered are surface roughness, slope, size of flood benches and sinuosity.

Attributes to be considered	WW4 -W1	WW4 -W2	WW4 -W3	Justification
Streamflow augmentation	2	2	1	Scores reflect differences in the size and representation of different hydroperiods for each wetland. Wetlands with > 50% permanent saturation/inundation and that are directly connected to a downslope stream were scored higher. A temporary isolated wetland (such as a small seep) scored lower.
Sediment trapping	3	3	1	Scores reflect differences in estimated likely sediment yields from the catchments of each wetland (highest for steep catchments with no vegetation cover) against the ability of each wetland to trap sediment. Wetlands with diffuse flow patterns have high capacity to trap sediment and so scored higher while wetlands with strongly channelled flows and drains scored lower. Scoring also considered how frequently stormflows move through the wetland (>1 in 5 years likely to score lower, while >1 per year score higher).
Water purification	3	3	1	Scores consider sources of contamination in the wetland's catchment (agrichemicals, urban runoff etc) and the wetland's capacity to treat water (size relative to catchment and hydrological modification). As an example, a pasture wetland that is >10% of catchment and which retains hydrological integrity scored higher, while a very small wetland that was <1% of its catchment and modified scored lower.
Connectivity and migration	1	1	1	Scores reflect differences in the position of wetlands within the larger stream networks.
Combined value	**M**	**M**	**L**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

8.5 NOR 5: Sandspit Road Upgrade

Table 18-30 Assessment of ecological value for wetland ecology features for NOR 5

Attributes to be considered	WW5-W1	WW5-W2	WW5-W3	Justification
Representativeness	**1**	**1**	**1**	
Hydrological modification	1	1	1	Scoring considered abstraction (including the presence and extent of exotic trees with high evapotranspiration rates), regulation by impoundments, drains or increased runoff from agricultural land or urban development.
Rarity/distinctiveness	**2**	**3**	**3**	
Species of conservation significance	2	3	3	Australasian bittern (Threatened – Nationally Critical, value score of 4) and spotless crake (At Risk - Declining, value score of 3) potential to utilise moderate to large sized wetlands (> 3000 m2) in the NOR (WW5-W2, WW5-W3) for foraging. Australasian bittern likely to only forage in this habitat, not nest, therefore a score of 3 has been assigned. Non-TAR native species (value score of 2) expected to utilise all wetlands in the NOR.
Vegetation type of conservation significance	1	1	1	Exotic dominated vegetation.
Diversity and pattern	**2**	**2**	**2**	
Diversity of habitat types	2	2	2	Scores reflect differences in the representation of different habitats associated with the period of inundation and or saturation. For example, for small wetlands (< 100 m2) that provide only temporary (<3 months/yr.) saturation was scored lower while larger wetlands (> 500 m2) with permanent, seasonal and temporary habitat scored higher.
Ecological context	**1**	**2**	**2**	
Flood attenuation	1	2	2	Scores reflect differences in wetland size in relation to its catchment (a wetland size that is >10% of its catchment was scored higher). Additional consideration was given to the way in which stormflows are spread across the wetland. Other factors considered are surface roughness, slope, size of flood benches and sinuosity.

Attributes to be considered	WW5-W1	WW5-W2	WW5-W3	Justification
Streamflow augmentation	1	1	1	Scores reflect differences in the size and representation of different hydroperiods for each wetland. Wetlands with > 50% permanent saturation/inundation and that are directly connected to a downslope stream were scored higher. A temporary isolated wetland (such as a small seep) scored lower.
Sediment trapping	1	2	2	Scores reflect differences in estimated likely sediment yields from the catchments of each wetland (highest for steep catchments with no vegetation cover) against the ability of each wetland to trap sediment. Wetlands with diffuse flow patterns have high capacity to trap sediment and so scored higher while wetlands with strongly channelled flows and drains scored lower. Scoring also considered how frequently stormflows move through the wetland (>1 in 5 years likely to score lower, while >1 per year score higher).
Water purification	1	1	2	Scores consider sources of contamination in the wetland's catchment (agrichemicals, urban runoff etc) and the wetland's capacity to treat water (size relative to catchment and hydrological modification). As an example, a pasture wetland that is >10% of catchment and which retains hydrological integrity scored higher, while a very small wetland that was <1% of its catchment and modified scored lower.
Connectivity and migration	1	1	1	Scores reflect differences in the position of wetlands within the larger stream networks.
Combined value	**L**	**L**	**L**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

8.6 NOR 6: New Western Link - South

Table 18-31 Assessment of ecological value for wetland ecology features for NOR 6

Attributes to be considered	WW6 -O1	WW6 -O2	WW6 -W1	Justification
Representativeness	**1**	**1**	**1**	
Hydrological modification	1	1	1	Scoring considered abstraction (including the presence and extent of exotic trees with high evapotranspiration rates), regulation by impoundments, drains or increased runoff from agricultural land or urban development.
Rarity/distinctiveness	**2**	**2**	**3**	
Species of conservation significance	2	2	3	Australasian bittern (Threatened – Nationally Critical, value score of 4) and spotless crake (At Risk - Declining, value score of 3) potential to utilise the area of WL19 (WW6-W1) and associated intermittent stream which is proposed to be bridged. Also, potential to utilise an exotic wetland at the eastern side of the NOR (WW3-W1 - assessed in the NOR 3 value assessment). Australasian bittern likely to only forage in this habitat, not nest, therefore a score of 3 has been assigned. Non-TAR native species (value score of 2) expected to utilise all wetlands and ponds in the NOR.
Vegetation type of conservation significance	1	1	3	WW6-O1 & WW6-O2: stormwater pond with limited exotic vegetation. WW6-W1: Raupō reedland, endangered ecosystem type.
Diversity and pattern	**1**	**1**	**3**	
Diversity of habitat types	1	1	3	Scores reflect differences in the representation of different habitats associated with the period of inundation and or saturation. For example, for small wetlands (< 100 m2) that provide only temporary (<3 months/yr.) saturation was scored lower while larger wetlands (> 500 m2) with permanent, seasonal and temporary habitat scored higher.
Ecological context	**2**	**3**	**3**	
Flood attenuation	1	1	2	Scores reflect differences in wetland size in relation to its catchment (a wetland size that is >10% of its catchment was scored higher). Additional consideration was given to the way in which stormflows are spread across the wetland. Other factors considered are surface roughness, slope, size of flood benches and sinuosity.

Attributes to be considered	WW6 -O1	WW6 -O2	WW6 -W1	Justification
Streamflow augmentation	1	1	3	Scores reflect differences in the size and representation of different hydroperiods for each wetland. Wetlands with > 50% permanent saturation/inundation and that are directly connected to a downslope stream were scored higher. A temporary isolated wetland (such as a small seep) scored lower.
Sediment trapping	2	3	2	Scores reflect differences in estimated likely sediment yields from the catchments of each wetland (highest for steep catchments with no vegetation cover) against the ability of each wetland to trap sediment. Wetlands with diffuse flow patterns have high capacity to trap sediment and so scored higher while wetlands with strongly channelled flows and drains scored lower. Scoring also considered how frequently stormflows move through the wetland (>1 in 5 years likely to score lower, while >1 per year score higher).
Water purification	2	3	2	Scores consider sources of contamination in the wetland's catchment (agrichemicals, urban runoff etc) and the wetland's capacity to treat water (size relative to catchment and hydrological modification). As an example, a pasture wetland that is >10% of catchment and which retains hydrological integrity scored higher, while a very small wetland that was <1% of its catchment and modified scored lower.
Connectivity and migration	1	1	1	Scores reflect differences in the position of wetlands within the larger stream networks.
Combined value	**L**	**L**	**M**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

8.7 NOR 7: Sandspit Link

Table 18-32 Assessment of ecological value for wetland ecology features for NOR 7

Attributes to be considered	WW7-W1	WW7-W2	WW7-W3	WW7-W4	WW7-W5	WW7-W6	WW7-W7	WW7-W8	Justification
Representativeness	**1**	**1**	**2**	**1**	**2**	**2**	**1**	**1**	
Hydrological modification	1	1	2	1	2	2	1	1	Scoring considered abstraction (including the presence and extent of exotic trees with high evapotranspiration rates), regulation by impoundments, drains or increased runoff from agricultural land or urban development.
Rarity/distinctiveness	**2**	**2**	**3**	**2**	**2**	**2**	**2**	**2**	
Species of conservation significance	2	2	3	2	2	2	2	2	Australasian bittern (Threatened – Nationally Critical, value score of 4) and spotless crake (At Risk - Declining, value score of 3) potentially utilising large wetlands (> 5000 m2) that are present in the NOR (WW7-W3) for foraging and nesting. Australasian bittern likely to only forage in this habitat, not nest, therefore a score of 3 has been assigned. Black shag (At Risk - Naturally Uncommon), little black shag (At Risk - Naturally Uncommon), pied shag (At Risk - Recovering), little shag (At Risk - Relict) (all value score of 3), likely utilising open water in the NOR but not expected to be utilising or relying on wetlands in this NOR. Non-TAR native species (value score of 2) expected to utilise all wetlands and ponds in the NOR.
Vegetation type of conservation significance	1	1	1	1	1	1	1	1	Exotic dominated vegetation.
Diversity and pattern	**2**	**2**	**3**	**1**	**2**	**2**	**2**	**2**	

Attributes to be considered	WW7-W1	WW7-W2	WW7-W3	WW7-W4	WW7-W5	WW7-W6	WW7-W7	WW7-W8	Justification
Diversity of habitat types	2	2	3	1	2	2	2	2	Scores reflect differences in the representation of different habitats associated with the period of inundation and or saturation. For example, for small wetlands (< 100 m2) that provide only temporary (<3 months/yr.) saturation was scored lower while larger wetlands (> 500 m2) with permanent, seasonal and temporary habitat scored higher.
Ecological context	**1**	**2**	**3**	**1**	**2**	**2**	**2**	**1**	
Flood attenuation	1	1	3	1	2	2	2	1	Scores reflect differences in wetland size in relation to its catchment (a wetland size that is >10% of its catchment was scored higher). Additional consideration was given to the way in which stormflows are spread across the wetland. Other factors considered are surface roughness, slope, size of flood benches and sinuosity.
Streamflow augmentation	1	1	2	1	1	1	2	1	Scores reflect differences in the size and representation of different hydroperiods for each wetland. Wetlands with > 50% permanent saturation/inundation and that are directly connected to a downslope stream were scored higher. A temporary isolated wetland (such as a small seep) scored lower.
Sediment trapping	1	1	3	1	2	2	2	1	Scores reflect differences in estimated likely sediment yields from the catchments of each wetland (highest for steep catchments with no vegetation cover) against the ability of each wetland to trap sediment. Wetlands with diffuse flow patterns have high capacity to trap sediment and so scored higher while wetlands with strongly channelled flows and drains scored lower. Scoring also considered how frequently stormflows move through the wetland (>1 in 5 years likely to score lower, while >1 per year score higher).
Water purification	1	1	3	1	2	2	2	1	Scores consider sources of contamination in the wetland's catchment (agrichemicals, urban runoff etc) and the wetland's capacity to treat water (size relative to catchment and hydrological modification). As an example, a pasture wetland that is >10% of catchment and which retains hydrological integrity scored higher, while a very small wetland that was <1% of its catchment and modified scored lower.
Connectivity and migration	1	2	2	1	1	1	1	1	Scores reflect differences in the position of wetlands within the larger stream networks.

Attributes to be considered	WW7-W1	WW7-W2	WW7-W3	WW7-W4	WW7-W5	WW7-W6	WW7-W7	WW7-W8	Justification
Combined value	**L**	**L**	**M**	**L**	**L**	**L**	**L**	**L**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

8.8 NOR 8: Wider Western Link (North)

Table 18-33 Assessment of ecological value for wetland ecology features for NOR 8

Attributes to be considered	WW8-W1	WW8-W2	WW8-W3	WW8-W4	Justification
Representativeness	**2**	**1**	**1**	**2**	
Hydrological modification	2	1	1	2	Scoring considered abstraction (including the presence and extent of exotic trees with high evapotranspiration rates), regulation by impoundments, drains or increased runoff from agricultural land or urban development.
Rarity/distinctiveness	**4**	**2**	**2**	**3**	
Species of conservation significance	4	2	2	3	Dabchick (Threatened - Nationally Increasing, value score of 4) likely utilising open water associated with planted wetlands in the NOR (WW8-W1) for foraging and nesting. Australasian bittern (Threatened – Nationally Critical, value score of 4) and spotless crake (At Risk - Declining, value score of 3) likely utilising large (> 5000 m2) wetlands present in the NOR (WW8-W1 and WW8-W4) for foraging, spotless crake may also be nesting in these areas. Australasian bittern likely to only forage in this habitat, not nest, therefore a score of 3 has been assigned. Non-TAR native species (value score of 2) expected to utilise all wetlands and ponds in the NOR.
Vegetation type of conservation significance	2	1	1	1	Planted native vegetation at WW8-W1 (Non-TAR species). Exotic dominated vegetation at all other wetlands.
Diversity and pattern	**3**	**1**	**1**	**2**	
Diversity of habitat types	3	1	1	2	Scores reflect differences in the representation of different habitats associated with the period of inundation and or saturation. For example, for small wetlands (< 100 m2) that provide only temporary (<3 months/yr.) saturation was scored lower while larger wetlands (> 500 m2) with permanent, seasonal and temporary habitat scored higher.
Ecological context	**3**	**1**	**1**	**3**	

Attributes to be considered	WW8-W1	WW8-W2	WW8-W3	WW8-W4	Justification
Flood attenuation	2	1	1	3	Scores reflect differences in wetland size in relation to its catchment (a wetland size that is >10% of its catchment was scored higher). Additional consideration was given to the way in which stormflows are spread across the wetland. Other factors considered are surface roughness, slope, size of flood benches and sinuosity.
Streamflow augmentation	3	1	1	2	Scores reflect differences in the size and representation of different hydroperiods for each wetland. Wetlands with > 50% permanent saturation/inundation and that are directly connected to a downslope stream were scored higher. A temporary isolated wetland (such as a small seep) scored lower.
Sediment trapping	2	1	1	3	Scores reflect differences in estimated likely sediment yields from the catchments of each wetland (highest for steep catchments with no vegetation cover) against the ability of each wetland to trap sediment. Wetlands with diffuse flow patterns have high capacity to trap sediment and so scored higher while wetlands with strongly channelled flows and drains scored lower. Scoring also considered how frequently stormflows move through the wetland (>1 in 5 years likely to score lower, while >1 per year score higher).
Water purification	3	1	1	3	Scores consider sources of contamination in the wetland's catchment (agrichemicals, urban runoff etc) and the wetland's capacity to treat water (size relative to catchment and hydrological modification). As an example, a pasture wetland that is >10% of catchment and which retains hydrological integrity scored higher, while a very small wetland that was <1% of its catchment and modified scored lower.
Connectivity and migration	2	1	1	2	Scores reflect differences in the position of wetlands within the larger stream networks.
Combined value	**M**	**L**	**L**	**M**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very Hig

9 Appendix 9 – Impact Assessment

NoR R1														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Construction	Noise/lighting/vibration/ dust	R1-Bat	Very High	Construction- Bats	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.)	Baseline. Stream-wetland complex, predominantly exotic scrub (gorse). Permanent stream is approximately 150 metres southwest of existing State Highway 1 and within 50 metres of ongoing construction in the area (unrelated to the Project). If bats are present, they are unlikely to be disturbed by construction activities (due to habituation to current conditions).	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Low
Operation	Presence of the road	R1-Bat	Very High	Operation- Bats	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	Baseline. Permanent stream to be bridged (new fragmentation), stream potentially used by bats commuting between SEA to the West of the Project Area, to Seas within the Project Area. Probability Unlikely due to Existing degree of fragmentation. Extent decreased to Local as potential connectivity effects will be local in the context of this NOR	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low
Operation	Presence of the road	R1-Bat	Very High	Operation- Bats	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration	Baseline. Stream-wetland complex, predominantly exotic scrub (gorse). Permanent stream is approximately 150 metres southwest of existing State Highway 1 and within 50 metres of ongoing construction in the area (unrelated to the Project). If bats are present, they are unlikely to be disturbed by presence of the road (due to habituation to current conditions).	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low
Construction	Noise/lighting/vibration/ dust	R1-Bat	Very High	Construction- Bats	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.)	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Business Zones. Bats unlikely to be disturbed by construction activities in this environment.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Low
Operation	Presence of the road	R1-Bat	Very High	Operation- Bats	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Business Zones. However, it is anticipated that streams and riparian areas are maintained in the likely future ecological environment. The permanent stream may facilitate commuting for bats between Seas in the area and the stream crossing would be new fragmentation. Probability Unlikely due to urban expansion and uncertainty regarding the quality of riparian features in the future	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low
Operation	Presence of the road	R1-Bat	Very High	Operation- Bats	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Business Zones. Bats unlikely to be disturbed by presence of the road in this environment.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low
Construction	Noise/lighting/vibration/ dust	R1 - Non-TAR bird	Low	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Stream-wetland complex, predominantly exotic scrub (gorse). Permanent stream is approximately 150 metres southwest of existing State Highway 1 and within 50 metres of ongoing construction in the area (unrelated to the Project). If birds are present, they are likely to be disturbed by construction activities resulting in small, local changes to the population dynamics. The most conservative non-TAR species, such as grey warbler, has been used for this assessment.	Indirect	Local	Short-term (<5 years)	Frequently	Likely	Totally	Low	Very Low
Operation	Presence of the road	R1 - Non-TAR bird	Low	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Permanent stream to be bridged (new fragmentation), stream likely utilised by non-TAR native birds, therefore loss in connectivity is highly likely, resulting in changes to the population dynamics. The most conservative non-TAR species, such as grey warbler, has been used for this assessment.	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Very Low
Operation	Presence of the road	R1 - Non-TAR bird	Low	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Permanent stream to be bridged (new fragmentation), stream likely utilised by non-TAR native birds, therefore loss in connectivity is highly likely, resulting in changes to the population dynamics. The most conservative non-TAR species, such as grey warbler, has been used for this assessment.	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Very Low

NoR R1														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Operation	Presence of the road	R1 - Non-TAR bird	Low	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Stream-wetland complex, predominantly exotic scrub (gorse). Permanent stream is approximately 150 metres southwest of existing State Highway 1 and within 50 metres of ongoing construction in the area (unrelated to the Project). If birds are present, they are likely to be disturbed by presence of the road (due to habituation to current conditions), resulting in changes to the population dynamics. The most conservative non-TAR species, such as grey warbler, has been used for this assessment.	Indirect	Local	Permanent (>25 years)	Continuously	Likely	Irreversible	Low	Very Low
Construction	Noise/lighting/vibration/ dust	R1 - Non-TAR bird	Low	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Business Zones. It is anticipated that birds present will be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely		Negligible	Very Low
Operation	Presence of the road	R1 - Non-TAR bird	Low	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Business Zones. It is anticipated that the habitat will already be fragmented in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely		Negligible	Very Low
Operation	Presence of the road	R1 - Non-TAR bird	Low	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Business Zones. It is anticipated that birds present will be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)	Continuously	Unlikely		Low	Very Low
Construction	Noise/lighting/vibration/ dust	R1 - New Zealand pipit	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. New Zealand pipit have the potential to utilise any open habitat such as Exotic Grassland and Exotic Scrub (both present in NoR R1). Note: 'Definite' likelihood assigned, as New Zealand pipit will require specific management during construction to prevent disturbance to nesting birds in the area.	Indirect	Local	Short-term (<5 years)	Frequently	Definite	Totally	Moderate	High
Operation	Presence of the road	R1 - New Zealand pipit	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. New Zealand pipit have the potential to utilise any open habitat such as Exotic Grassland and Exotic Scrub (both present in NoR R1). Effect is unlikely due to low densities of New Zealand pipit expected in the Zone of Influence.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R1 - New Zealand pipit	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. New Zealand pipit have the potential to utilise any open habitat such as Exotic Grassland and Exotic Scrub (both present in NoR R1). Effect is unlikely due to low densities of New Zealand pipit expected in the Zone of Influence.	Indirect	Local	Permanent (>25 years)	Frequently	Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R1 - New Zealand pipit	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Business Zones. Suitable habitat for New Zealand pipit is not anticipated to be present in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R1 - New Zealand pipit	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Business Zones. Suitable habitat for New Zealand pipit is not anticipated to be present in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline..	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low

NoR R1														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Operation	Presence of the road	R1 - New Zealand pipit	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Business Zones. Suitable habitat for New Zealand pipit is not anticipated to be present in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)	Frequently	Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R1 - Australasian bittern	Very High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Australasian bittern have the potential to utlise large wetlands (> 5000 m2) in the NoR for foraging. In NoR R1, this is wetland WW1-W1. They are considered a mobile species in this area, with high dispersal, and unlikely to be nesting. Therefore disturbance resulting in changes to the population dynamics is considered unlikely.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Low
Operation	Presence of the road	R1 - Australasian bittern	Very High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Australasian bittern have the potential to utlise large wetlands (> 5000 m2) in the NoR for foraging. In NoR R1, this is wetland WW1-W1. They are considered a mobile species in this area, with high dispersal. Therefore loss in connectivity resulting in changes to the population dynamics is considered unlikely.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low
Operation	Presence of the road	R1 - Australasian bittern	Very High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Australasian bittern have the potential to utlise large wetlands (> 5000 m2) in the NoR for foraging. In NoR R1, this is wetland WW1-W1. They are considered a mobile species in this area, with high dispersal, and unlikely to be nesting. Therefore disturbance resulting in changes to the population dynamics is considered unlikely.	Indirect	Local	Permanent (>25 years)	Periodically	Unlikely	Irreversible	Negligible	Low
Construction	Noise/lighting/vibration/ dust	R1 - Australasian bittern	Very High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Business Zones. Australasian bittern are considered a mobile species in this area, with high dispersal, and unlikely to be nesting. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Low
Operation	Presence of the road	R1 - Australasian bittern	Very High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Business Zones. It is anticipated that the habitat will already be fragmented in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low
Operation	Presence of the road	R1 - Australasian bittern	Very High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Business Zones. Australasian bittern are considered a mobile species in this area, with high dispersal, and unlikely to be nesting. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)	Periodically	Unlikely	Irreversible	Negligible	Low
Construction	Noise/lighting/vibration/ dust	R1 - Spotless crake	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Spotless crake have the potential to utlise large wetlands (> 5000 m2) in the NoR. In NoR R1, this is wetland WW1-W1. Spotless crake are known to be in the wider area as they have been picked up in nearby acoustic surveys, and have the potential to be nesting in wetlands present in the NoR (M. Baber, personal communication, 27 January 2023). Note: A manual 'Moderate' level of effect has been assigned, as spotless crake will require specific management during construction to prevent disturbance to nesting birds in the area.	Indirect	Local	Short-term (<5 years)	Frequently	Highly Likely	Totally	Low	Moderate

NoR R1														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Operation	Presence of the road	R1 - Spotless crake	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Spotless crake have the potential to utlise large wetlands (> 5000 m2) in the NoR. In NoR R1, this is wetland WW1-W1. Spotless crake are considered to have 'good dispersal ability' (Cotter, 2016). Therefore loss in connectivity resulting in changes to the population dynamics is considered unlikely.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R1 - Spotless crake	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Spotless crake have the potential to utlise large wetlands (> 5000 m2) in the NoR. In NoR R1, this is wetland WW1-W1. Spotless crake are known to be in the wider area as they have been picked up in nearby acoustic surveys, and have the potential to be nesting in wetlands present in the NoR (M. Baber, personal communication, 27 January 2023). Note: A manual 'Moderate' level of effect has been assigned, as spotless crake will require specific management to prevent disturbance to nesting birds in the area from the presence of the road.	Indirect	Local	Permanent (>25 years)	Infrequently	Likely	Irreversible	Low	Moderate
Construction	Noise/lighting/vibration/ dust	R1 - Spotless crake	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Business Zones. Delineated wetlands will be retained (and habitat quality likely improved) in the Likely Future Ecological Environment. Therefore there is higher potential for spotless crake to be foraging and nesting in this habitat, and could be disturbed by construction activities. Note: A manual 'Moderate' level of effect has been assigned, as spotless crake will require specific management during construction to prevent disturbance to nesting birds in the area.	Indirect	Local	Short-term (<5 years)	Frequently	Highly Likely	Totally	Low	Moderate
Operation	Presence of the road	R1 - Spotless crake	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Business Zones. It is anticipated that the delineated wetland area (spotless crake habitat) will remain, however will already be fragmented in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R1 - Spotless crake	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Business Zones. Delineated wetlands will be retained (and habitat quality likely improved) in the Likely Future Ecological Environment. Therefore there is higher potential for spotless crake to be foraging and nesting in this habitat, and could be disturbed by the presence of the road. Note: A manual 'Moderate' level of effect has been assigned, as spotless crake will require specific management to prevent disturbance to nesting birds in the area from the presence of the road.	Indirect	Local	Permanent (>25 years)	Infrequently	Likely	Irreversible	Low	Moderate
Construction	Noise/lighting/vibration/ dust	R1 - Copper skink	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Stream-wetland complex, predominantly exotic scrub (gorse). Permanent stream is approximately 150 metres southwest of existing State Highway 1 and within 50 metres of ongoing construction in the area (unrelated to the Project). Disturbance to copper skink resulting in changes to the local population dynamics is considered likely (due to the value of gorse as copper skink habitat).	Indirect	Local	Short-term (<5 years)	Frequently	Likely	Totally	Low	Low
Operation	Presence of the road	R1 - Copper skink	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Loss in connectivity for copper skink resulting in changes to the population dynamics is considered unlikely due to the their 'small home range' (New Zealand Herpetological Society, 2022).	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low

NoR R1														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Operation	Presence of the road	R1 - Copper skink	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Baseline. Stream-wetland complex, predominantly exotic scrub (gorse). Permanent stream is approximately 150 metres southwest of existing State Highway 1 and within 50 metres of ongoing construction in the area (unrelated to the Project). Disturbance to copper skink resulting in changes to the population dynamics is considered unlikely (due to habituation to existing disturbance).	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R1 - Copper skink	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Business Zones. Suitable habitat for copper skink is not anticipated to be present (or very limited/low quality) in this environment. Only residual copper skink habitat in the FEE will be associated with riparian margin, therefore an expected decrease in frequency and likelihood Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Infrequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R1 - Copper skink	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Business Zones. Suitable habitat for copper skink is not anticipated to be present (or very limited/low quality) in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R1 - Copper skink	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Business Zones. Suitable habitat for copper skink is not anticipated to be present (or very limited/low quality) in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Very Low

NoR R2														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Construction	Noise/lighting/vibration/ dust	R2-Bat	Very High	Construction- Bats	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.)	Baseline. Upgrade of existing road, however a large stand of native terrestrial vegetation (WF11) is present 25 metres north of the NoR. Bat roosts may be present and potentially be disturbed by noise, vibration and light from construction activities. Two permanent streams will be crossed in NoR, which are likely to be utilised by bats for commuting and foraging.	Indirect	Local	Short-term (<5 years)	Frequently	Likely	Totally	Low	Moderate
Operation	Presence of the road	R2-Bat	Very High	Operation- Bats	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	Baseline. Two permanent stream will be crossed in NoR, which are likely to be utilised by bats for commuting and foraging. Although the streams are already bridged, there is increased probability of additional fragmentation (particularly along the Mahurangi River).	Indirect	Regional	Permanent (>25 years)		Likely	Irreversible	Moderate	High
Operation	Presence of the road	R2-Bat	Very High	Operation- Bats	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration	Baseline. Proximity of road operation to bat habitat informs Likely disturbance effect during operation. Upgrade of existing road, bats in area are likely habituated to road disturbance.	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Moderate
Construction	Noise/lighting/vibration/ dust	R2-Bat	Very High	Construction- Bats	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.)	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Bats unlikely to be disturbed by construction activities in this environment.	Indirect	Local	Short-term (<5 years)	Frequently	Likely	Totally	Low	Moderate
Operation	Presence of the road	R2-Bat	Very High	Operation- Bats	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	Likely Future Ecological Environment. The eastern portion of the NoR is located in Future Urban Zone, while the area west of the Mahurangi River will remain rural. It is anticipated that the ecological values of streams and riparian areas will increase in the future. The permanent streams would become an important commuting corridor for bats between SEAs in the area, and there is increased probability of additional fragmentation.	Indirect	Regional	Permanent (>25 years)		Likely	Irreversible	Moderate	High
Operation	Presence of the road	R2-Bat	Very High	Operation- Bats	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration	Likely Future Ecological Environment. Area of higher bat habitat value located in future rural zone, therefore same as baseline. NoR is located in Future Urban Zone. Bats unlikely to be disturbed by presence of the road in this environment.	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Moderate
Construction	Noise/lighting/vibration/ dust	R2 - Non-TAR bird	Low	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Upgrade of existing road, a large stand of native terrestrial vegetation (TL.1) is present 25 metres north of the NoR. Two permanent streams will also be crossed in NoR (already bridged). If birds are present, they are unlikely to be disturbed by construction activities (due to habituation to current conditions) and is unlikely to result result in changes to the population dynamics. The most conservative non-TAR species, such as grey warbler, has been used for this assessment.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R2 - Non-TAR bird	Low	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Upgrade of existing road, a large stand of native terrestrial vegetation (TL.1) is present 25 metres north of the NoR. Two permanent streams will also be crossed in NoR (already bridged). Existing baseline fragmentation (existing road and bridged streams) means that loss in connectivity resulting in changes to the population dynamics is unlikely. The most conservative non-TAR species, such as grey warbler, has been used for this assessment.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R2 - Non-TAR bird	Low	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Upgrade of existing road, a large stand of native terrestrial vegetation (TL.1) is present 25 metres north of the NoR. Two permanent streams will also be crossed in NoR (already bridged). If birds are present, they are unlikely to be disturbed by presence of the road (due to habituation to current conditions), and is unlikely to result in changes to the population dynamics. The most conservative non-TAR species, such as grey warbler, has been used for this assessment.	Indirect	Local	Permanent (>25 years)	Continuously	Unlikely	Irreversible	Low	Very Low

NoR R2														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Construction	Noise/lighting/vibration/ dust	R2 - Non-TAR bird	Low	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. It is anticipated that birds present will be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R2 - Non-TAR bird	Low	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. It is anticipated that the habitat will already be fragmented in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R2 - Non-TAR bird	Low	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. It is anticipated that birds present will be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)	Continuously	Unlikely	Irreversible	Low	Very Low
Construction	Noise/lighting/vibration/ dust	R2 - New Zealand pipit	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. New Zealand pipit have the potential to utilise any open habitat such as Exotic Grassland and Exotic Scrub (both present in NoR R2). Note: 'Definite' likelihood assigned, as New Zealand pipit will require specific management during construction to prevent disturbance to nesting birds in the area.	Indirect	Local	Short-term (<5 years)	Frequently	Definite	Totally	Moderate	High
Operation	Presence of the road	R2 - New Zealand pipit	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. New Zealand pipit have the potential to utilise any open habitat such as Exotic Grassland and Exotic Scrub (both present in NoR R2). Effect is unlikely due to low densities of New Zealand pipit expected in the Zone of Influence.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R2 - New Zealand pipit	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. New Zealand pipit have the potential to utilise any open habitat such as Exotic Grassland and Exotic Scrub (both present in NoR R2). Effect is unlikely due to low densities of New Zealand pipit expected in the Zone of Influence.	Indirect	Local	Permanent (>25 years)	Frequently	Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R2 - New Zealand pipit	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Suitable habitat for New Zealand pipit is not anticipated to be present in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R2 - New Zealand pipit	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Suitable habitat for New Zealand pipit is not anticipated to be present in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R2 - New Zealand pipit	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Suitable habitat for New Zealand pipit is not anticipated to be present in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Very Low

NoR R2														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Construction	Noise/lighting/vibration/ dust	R2 - North Island kākā	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Kākā are considered a highly mobile species in this area, with seasonal use and high dispersal. Therefore they are unlikely to be disturbed by construction activities.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R2 - North Island kākā	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Existing baseline fragmentation (existing road and bridged streams) means that loss in connectivity resulting in changes to the population dynamics is unlikely.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R2 - North Island kākā	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Kākā are considered a highly mobile species in this area, with seasonal use and high dispersal. Therefore they are unlikely to be disturbed by the presence of the road.	Indirect	Local	Permanent (>25 years)	Frequently	Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R2 - North Island kākā	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. It is anticipated that birds present will be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R2 - North Island kākā	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. It is anticipated that the habitat will already be fragmented in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R2 - North Island kākā	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. It is anticipated that birds present will be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)	Frequently	Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R2 - Long-tailed cuckoo	Very High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Long-tailed cuckoo are considered a highly mobile species in this area, with high dispersal. Therefore they are unlikely to be disturbed by construction activities.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Low
Operation	Presence of the road	R2 - Long-tailed cuckoo	Very High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Existing baseline fragmentation (existing road and bridged streams) means that loss in connectivity resulting in changes to the population dynamics is unlikely.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low
Operation	Presence of the road	R2 - Long-tailed cuckoo	Very High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Long-tailed cuckoo are considered a highly mobile species in this area, with high dispersal. In addition, as the NoR is an upgrade of an existing road, it is expected that long-tailed cuckoo would be habituated to road disturbance. Therefore they are unlikely to be disturbed by the presence of the road.	Indirect	Local	Permanent (>25 years)	Frequently	Unlikely	Irreversible	Negligible	Low

NoR R2														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Construction	Noise/lighting/vibration/ dust	R2 - Long-tailed cuckoo	Very High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. It is anticipated that birds present will be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Low
Operation	Presence of the road	R2 - Long-tailed cuckoo	Very High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. It is anticipated that the habitat will already be fragmented in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low
Operation	Presence of the road	R2 - Long-tailed cuckoo	Very High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. It is anticipated that birds present will be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)	Frequently	Unlikely	Irreversible	Negligible	Low
Construction	Noise/lighting/vibration/ dust	R2 - Black shag	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Likely utilising open water in the NoR (WW2-S1, WW2-S2, WW2-S3). The NoR is for an upgrade of an existing road, which already crosses WW2-S2 and WW2-S3. It is anticipated that they are unlikely to be disturbed by construction activities (due to habituation to current conditions).	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R2 - Black shag	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Likely utilising open water in the NoR (WW2-S1, WW2-S2, WW2-S3). Existing baseline fragmentation, and although there will be a slight increase in fragmentation (increased bridge size) at WW2-S2 and WW2-S3, it is unlikely that this loss in connectivity would result in changes to the population dynamics.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R2 - Black shag	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Likely utilising open water in the NoR (WW2-S1, WW2-S2, WW2-S3). The NoR is for an upgrade of an existing road, which already crosses WW2-S2 and WW2-S3. It is anticipated that they are unlikely to be disturbed by the presence of the road (due to habituation to current conditions) .	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R2 - Black shag	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. It is anticipated that birds present will be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R2 - Black shag	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. However, open water is anticipated to remain (WW2-S1, WW2-S2, WW2-S3). Existing baseline fragmentation, and although there will be a slight increase in fragmentation (increased bridge size) at WW2-S2 and WW2-S3, it is unlikely that this loss in connectivity would result in changes to the population dynamics.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R2 - Black shag	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. It is anticipated that birds present will be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Very Low

NoR R2														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Construction	Noise/lighting/vibration/ dust	R2 - Little black shag, pied shag, little shag	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Likely utilising open water in the NoR (WW2-S1, WW2-S2, WW2-S3). The NoR is for an upgrade of an existing road, which already crosses WW2-S2 and WW2-S3. It is anticipated that they are unlikely to be disturbed by construction activities (due to habituation to current conditions) . Additionally, habitat at NoR R2 is considered less suitable for little black shag, pied shag, and little shag. Therefore, the habitat is less likely to be utilised in this area (compared to the black shag).	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R2 - Little black shag, pied shag, little shag	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Likely utilising open water in the NoR (WW2-S1, WW2-S2, WW2-S3). Existing baseline fragmentation, and although there will be a slight increase in fragmentation (increased bridge size) at WW2-S2 and WW2-S3, it is unlikely that this loss in connectivity would result in changes to the population dynamics. Additionally, habitat at NoR R2 is considered less suitable for little black shag, pied shag, and little shag. Therefore, the habitat is less likely to be utilised in this area (compared to the black shag).	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R2 - Little black shag, pied shag, little shag	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Likely utilising open water in the NoR (WW2-S1, WW2-S2, WW2-S3). The NoR is for an upgrade of an existing road, which already crosses WW2-S2 and WW2-S3. It is anticipated that they are unlikely to be disturbed by the presence of the road (due to habituation to current conditions) . Additionally, habitat at NoR R2 is considered less suitable for little black shag, pied shag, and little shag. Therefore, the habitat is less likely to be utilised in this area (compared to the black shag).	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R2 - Little black shag, pied shag, little shag	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. It is anticipated that birds present will be habituated to disturbance in this environment. Additionally, habitat at NoR R2 is considered less suitable for little black shag, pied shag, and little shag. Therefore, the habitat is less likely to be utilised in this area (compared to the black shag). Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R2 - Little black shag, pied shag, little shag	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. However, open water is anticipated to remain (WW2-S1, WW2-S2, WW2-S3). Additionally, habitat at NoR R2 is considered less suitable for little black shag, pied shag, and little shag. Therefore, the habitat is less likely to be utilised in this area (compared to the black shag). Existing baseline fragmentation, and although there will be a slight increase in fragmentation (increased bridge size) at WW2-S2 and WW2-S3, it is unlikely that this loss in connectivity would result in changes to the population dynamics.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low

NoR R2														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Operation	Presence of the road	R2 - Little black shag, pied shag, little shag	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. It is anticipated that birds present will be habituated to disturbance in this environment. Additionally, habitat at NoR R2 is considered less suitable for little black shag, pied shag, and little shag. Therefore, the habitat is less likely to be utilised in this area (compared to the black shag). Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R2 - Copper skink	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. As the NoR is an upgrade of existing road, disturbance to copper skink resulting in changes to the population dynamics is considered unlikely (due to habituation to existing disturbance).	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R2 - Copper skink	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. As the NoR is an upgrade of existing road, loss in connectivity for copper skink resulting in changes to the population dynamics is considered unlikely due to the their 'small home range' (New Zealand Herpetological Society, 2022).	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R2 - Copper skink	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Baseline. As the NoR is an upgrade of existing road, disturbance to copper skink resulting in changes to the population dynamics is considered unlikely (due to habituation to existing disturbance).	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R2 - Copper skink	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Suitable habitat for copper skink is not anticipated to be present (or very limited/low quality) in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R2 - Copper skink	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Suitable habitat for copper skink is not anticipated to be present (or very limited/low quality) in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R2 - Copper skink	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Suitable habitat for copper skink is not anticipated to be present (or very limited/low quality) in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R2 - Ornate skink	High	Construction- Herpetofauna (native)	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.)	Baseline. As the NoR is an upgrade of existing road, disturbance to ornate skink resulting in changes to the population dynamics is considered unlikely (due to habituation to existing disturbance).	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R2 - Ornate skink	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	Baseline. As the NoR is an upgrade of existing road, loss in connectivity for ornate skink resulting in changes to the population dynamics is considered unlikely due to the their 'small home range, often of only a few metres if the habitat is suitable' (Taranaki Regional Council, 2022).	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R2 - Ornate skink	High	Operation- Herpetofauna (native)	Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration	Baseline. As the NoR is an upgrade of existing road, disturbance to ornate skink resulting in changes to the population dynamics is considered unlikely (due to habituation to existing disturbance).	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low

NoR R2														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Construction	Noise/lighting/vibration/ dust	R2 - Ornate skink	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Suitable habitat for ornate skink is not anticipated to be present (or very limited/low quality) in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R2 - Ornate skink	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Suitable habitat for ornate skink is not anticipated to be present (or very limited/low quality) in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R2 - Ornate skink	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Suitable habitat for ornate skink is not anticipated to be present (or very limited/low quality) in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R2 - Elegant gecko and forest gecko	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Arboreal gecko species are expected to utilise the large stand of native terrestrial vegetation (WF11) present 25 metres north of the NoR, and potentially the stand of mixed native/exotic terrestrial vegetation (TL.2) adjacent to WW2-S2. As they are nocturnal species, it is likely that they are sensitive to construction disturbance, particularly construction lighting at night.	Indirect	Local	Short-term (<5 years)	Frequently	Likely	Totally	Low	Low
Operation	Presence of the road	R2 - Elegant gecko and forest gecko	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Although data is limited on the home range of geckos, it is unlikely that a loss in connectivity that results in changes to the population dynamics will occur, due to the limited habitat loss that will occur. There will be some loss of WF11 along the northern edge of the existing road, and it is expected that TL.2 adjacent to WW2-S2 will be retained.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R2 - Elegant gecko and forest gecko	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Baseline. Arboreal gecko species are expected to utilise the large stand of native terrestrial vegetation (WF11) present 25 metres north of the NoR, and the stand of mixed native/exotic terrestrial vegetation (TL.2) adjacent to WW2-S2. As they are nocturnal species, it is likely that they are sensitive to lighting at night. However, as the NoR is an upgrade of an existing road, it is expected that these species would already be habituated to disturbance from the presence of the road.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R2 - Elegant gecko and forest gecko	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Although it is anticipated that suitable gecko habitat will be retained in the buffer of the permanent streams, it is expected that gecko will already be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R2 - Elegant gecko and forest gecko	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Although it is anticipated that suitable gecko habitat will be retained in the buffer of the permanent streams, the upgrade of the existing road is not expected to impact the remaining suitable habitat in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low

NoR R2														
Phase	**Project Activity**	**Resource Unit (Habitat/Species)**	**Ecological Value**	**Effect Description Main**	**Effect Description Detailed**	**Effects Description Manual**	**Type**	**Extent (ZOI)**	**Duration**	**Frequency**	**Likelihood**	**Reversibility**	**Magnitude (pre-mitigation)**	**Level of Effect (Pre-mitigation)**
Operation	Presence of the road	R2 - Elegant gecko and forest gecko	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Although it is anticipated that suitable gecko habitat will be retained in the buffer of the permanent streams, it is expected that gecko will already be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R2 - Pacific gecko	Moderate	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Arboreal gecko species are expected to utilise the large stand of native terrestrial vegetation (WF11) present 25 metres north of the NoR, and potentially the stand of mixed native/exotic terrestrial vegetation (TL.2) adjacent to WW2-S2. As they are nocturnal species, it is likely that they are sensitive to construction disturbance, particularly construction lighting at night.	Indirect	Local	Short-term (<5 years)	Frequently	Likely	Totally	Low	Low
Operation	Presence of the road	R2 - Pacific gecko	Moderate	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Although data is limited on the home range of gecko, it is unlikely that a loss in connectivity that results in changes to the population dynamics will occur, due to the limited habitat loss that will occur. There will be some loss of WF11 along the northern edge of the existing road, and it is expected that TL.2 adjacent to WW2-S2 will be retained.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R2 - Pacific gecko	Moderate	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Baseline. Arboreal gecko species are expected to utilise the large stand of native terrestrial vegetation (WF11) present 25 metres north of the NoR, and the stand of mixed native/exotic terrestrial vegetation (TL.2) adjacent to WW2-S2. As they are nocturnal species, it is likely that they are sensitive to lighting at night. However, as the NoR is an upgrade of an existing road, it is expected that these species would already be habituated to disturbance from the presence of the road.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R2 - Pacific gecko	Moderate	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Although it is anticipated that suitable gecko habitat will be retained in the buffer of the permanent streams, it is expected that gecko will already be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)		Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R2 - Pacific gecko	Moderate	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Although it is anticipated that suitable gecko habitat will be retained in the buffer of the permanent streams, the upgrade of the existing road is not expected to impact the remaining suitable habitat in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R2 - Pacific gecko	Moderate	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Although it is anticipated that suitable gecko habitat will be retained in the buffer of the permanent streams, it is expected that gecko will already be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low

NoR R3														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Construction	Noise/lighting/vibration/ dust	R3-Bat	Very High	Construction- Bats	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.)	Baseline. Upgrade of existing State Highway 1, bats are unlikely to be disturbed by construction activities due to the absence of high roost habitat and habituation to noise/light/vibration/dust.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Low
Operation	Presence of the road	R3-Bat	Very High	Operation- Bats	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	Baseline. Numerous stream crossings, streams in the southern half of the NoR have higher importance for commuting and foraging. However, streams are already bridged and the proposed upgrade is not expected to increase the likelihood of additional fragmentation	Indirect	Regional	Permanent (>25 years)		Unlikely	Irreversible	Low	Moderate
Operation	Presence of the road		Negligible	Operation- Bats	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration	Baseline. Upgrade of existing road, bats in area are likely habituated to road disturbance.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R3-Bat	Very High	Construction- Bats	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.)	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Bats unlikely to be disturbed by construction activities in this environment.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Low
Operation	Presence of the road	R3-Bat	Very High	Operation- Bats	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	Likely Future Ecological Environment. NoR is located in Future Urban Zone. However, it is anticipated that streams and riparian areas are maintained in the likely future ecological environment. The likelihood of additional fragmentation is considered Unlikely due relative small scale of the proposed upgrade, and the nature of the streams	Indirect	Regional	Permanent (>25 years)		Unlikely	Irreversible	Low	Moderate
Operation	Presence of the road	R3-Bat	Very High	Operation- Bats	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration	Likely Future Ecological Environment. NoR is located in Future Urban Zone and is an upgrade of an existing road. Bats unlikely to be disturbed by the presence of the road in this environment.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low
Construction	Noise/lighting/vibration/ dust	R3 - Non-TAR bird	Low	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Upgrade of existing State Highway 1. If birds are present, they are unlikely to be disturbed by construction activities (due to habituation to current conditions). The most conservative non-TAR species, such as grey warbler, has been used for this assessment.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R3 - Non-TAR bird	Low	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Upgrade of existing State Highway 1. Existing baseline fragmentation (existing road and bridged/culverted streams) means that loss in connectivity resulting in changes to the population dynamics is unlikely.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R3 - Non-TAR bird	Low	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Upgrade of existing State Highway 1. If birds are present, they are unlikely to be disturbed by the presence of the road (due to habituation to current conditions).	Indirect	Local	Permanent (>25 years)	Continuously	Unlikely	Irreversible	Low	Very Low
Construction	Noise/lighting/vibration/ dust	R3 - Non-TAR bird	Low	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. It is anticipated that birds present will be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R3 - Non-TAR bird	Low	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. It is anticipated that the habitat will already be fragmented in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R3 - Non-TAR bird	Low	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. It is anticipated that birds present will be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)	Continuously	Unlikely	Irreversible	Low	Very Low

NoR R3														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Construction	Noise/lighting/vibration/ dust	R3 - New Zealand pipit	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Upgrade of existing State Highway 1. New Zealand pipit have the potential to utilise any open habitat such as Exotic Grassland and Exotic Scrub (both present in NoR R3). Note: 'Definite' likelihood assigned, as New Zealand pipit will require specific management during construction to prevent disturbance to nesting birds in the area.	Indirect	Local	Short-term (<5 years)	Frequently	Definite	Totally	Moderate	High
Operation	Presence of the road	R3 - New Zealand pipit	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Upgrade of existing State Highway 1. New Zealand pipit have the potential to utilise any open habitat such as Exotic Grassland and Exotic Scrub (both present in NoR R3). Effect is unlikely due to low densities of New Zealand pipit expected in the Zone of Influence.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R3 - New Zealand pipit	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Upgrade of existing State Highway 1. New Zealand pipit have the potential to utilise any open habitat such as Exotic Grassland and Exotic Scrub (both present in NoR R3). Effect is unlikely due to low densities of New Zealand pipit expected in the Zone of Influence.	Indirect	Local	Permanent (>25 years)	Frequently	Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R3 - New Zealand pipit	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Suitable habitat for New Zealand pipit is not anticipated to be present in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Infrequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R3 - New Zealand pipit	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Suitable habitat for New Zealand pipit is not anticipated to be present in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R3 - New Zealand pipit	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Suitable habitat for New Zealand pipit is not anticipated to be present in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R3 - Spotless crake	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Upgrade of existing State Highway 1. Potential to utilise moderately sized wetlands (> 1000 m2) in the NoR (WW3-W1, WW3-W3, WW3-W4, WW3-W5) for foraging and nesting. Spotless crake are known to be in the wider area as they have been picked up in nearby acoustic surveys, and have the potential to be nesting in wetlands present in the NoR (M. Baber, personal communication, 27 January 2023). Note: A manual 'Moderate' level of effect has been assigned, as spotless crake will require specific management during construction to prevent disturbance to nesting birds in the area.	Indirect	Local	Short-term (<5 years)	Frequently	Highly Likely	Totally	Low	Moderate

NoR R3														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Operation	Presence of the road	R3 - Spotless crake	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Upgrade of existing State Highway 1. Potential to utilise moderately sized wetlands (> 1000 m2) in the NoR (WW3-W1, WW3-W3, WW3-W4, WW3-W5) for foraging and nesting. However, spotless crake are considered to have 'good dispersal ability' (Cotter, 2016). Therefore loss in connectivity resulting in changes to the population dynamics is considered unlikely.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R3 - Spotless crake	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Upgrade of existing State Highway 1. Potential to utilise moderately sized wetlands (> 1000 m2) in the NoR (WW3-W1, WW3-W3, WW3-W4, WW3-W5) for foraging and nesting. Spotless crake are known to be in the wider area as they have been picked up in nearby acoustic surveys, and have the potential to be nesting in wetlands present in the NoR (M. Baber, personal communication, 27 January 2023). Note: A manual 'Moderate' level of effect has been assigned, as spotless crake will require specific management to prevent disturbance to nesting birds in the area from the presence of the road.	Indirect	Local	Permanent (>25 years)	Frequently	Likely	Irreversible	Low	Moderate
Construction	Noise/lighting/vibration/ dust	R3 - Spotless crake	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Delineated wetlands will be retained (and habitat quality likely improved) in the Likely Future Ecological Environment. Therefore there is higher potential for spotless crake to be foraging and nesting in this habitat, and could be disturbed by construction activities. Note: A manual 'Moderate' level of effect has been assigned, as spotless crake will require specific management during construction to prevent disturbance to nesting birds in the area.	Indirect	Local	Short-term (<5 years)	Frequently	Highly Likely	Totally	Low	Moderate
Operation	Presence of the road	R3 - Spotless crake	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Although it is anticipated that the delineated wetland will be retained, spotless crake are considered to have 'good dispersal ability' (Cotter, 2016). Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R3 - Spotless crake	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Delineated wetlands will be retained (and habitat quality likely improved) in the Likely Future Ecological Environment. Therefore there is higher potential for spotless crake to be foraging and nesting in this habitat, and could be disturbed by the presence of the road. Note: A manual 'Moderate' level of effect has been assigned, as spotless crake will require specific management to prevent disturbance to nesting birds in the area from the presence of the road.	Indirect	Local	Permanent (>25 years)	Frequently	Likely	Irreversible	Low	Moderate

NoR R3														
Phase	**Project Activity**	**Resource Unit (Habitat/Species)**	**Ecological Value**	**Effect Description Main**	**Effect Description Detailed**	**Effects Description Manual**	**Type**	**Extent (ZOI)**	**Duration**	**Frequency**	**Likelihood**	**Reversibility**	**Magnitude (pre-mitigation)**	**Level of Effect (Pre-mitigation)**
Construction	Noise/lighting/vibration/ dust	R3 - Australasian bittern	Very High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Upgrade of existing State Highway 1. Possible to utilise moderately sized wetlands (> 1000 m2) in the NoR (WW3-W1, WW3-W3, WW3-W4, WW3-W5) for foraging (unlikely to be nesting in this habitat). Due to location of the proposed stormwater pond in relation to wetlands WW3-W3 and WW3-W4, it is likely that birds using this habitat will be disturbed. However, Australasian bittern are considered a highly mobile species in this area, with high dispersal. Therefore, it is unlikely that construction disturbance will result in changes to the population dynamics.	Indirect	Local	Short-term (<5 years)	Infrequently	Unlikely	Totally	Negligible	Low
Operation	Presence of the road	R3 - Australasian bittern	Very High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Upgrade of existing State Highway 1. Potential to utilise moderately sized wetlands (> 1000 m2) in the NoR (WW3-W1, WW3-W3, WW3-W4, WW3-W5) for foraging (unlikely to be nesting in this habitat). As Australasian bittern are considered a highly mobile species in this area, with high dispersal, a loss in connectivity that results in changes to the population dynamics is considered unlikely.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low
Operation	Presence of the road	R3 - Australasian bittern	Very High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Upgrade of existing State Highway 1. Potential to utilise moderately sized wetlands (> 1000 m2) in the NoR (WW3-W1, WW3-W3, WW3-W4, WW3-W5) for foraging (unlikely to be nesting in this habitat). Due to the existing disturbance from SH1, it is unlikely that disturbance from the presence of the road will result in changes to the population dynamics.	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Low
Construction	Noise/lighting/vibration/ dust	R3 - Australasian bittern	Very High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Australasian bittern are considered a mobile species in this area, with high dispersal, and unlikely to be nesting. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Infrequently	Unlikely	Totally	Negligible	Low
Operation	Presence of the road	R3 - Australasian bittern	Very High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Although it is anticipated that the delineated wetland will be retained, as Australasian bittern are considered a highly mobile species in this area, with high dispersal, a loss in connectivity that results in changes to the population dynamics is considered unlikely. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low
Operation	Presence of the road	R3 - Australasian bittern	Very High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Australasian bittern are considered a mobile species in this area, with high dispersal, and unlikely to be nesting. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Low
Construction	Noise/lighting/vibration/ dust	R3 - Copper skink	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Upgrade of existing State Highway 1. Disturbance to copper skink resulting in changes to the population dynamics is considered unlikely (due to habituation to existing disturbance).	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low

NoR R3														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Operation	Presence of the road	R3 - Copper skink	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Upgrade of existing State Highway 1. Loss in connectivity for copper skink resulting in changes to the population dynamics is considered unlikely due to the their 'small home range' (New Zealand Herpetological Society, 2022) and the existing fragmentation.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R3 - Copper skink	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Baseline. Upgrade of existing State Highway 1. Disturbance to copper skink resulting in changes to the population dynamics is considered unlikely (due to habituation to existing disturbance).	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R3 - Copper skink	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Suitable habitat for copper skink is not anticipated to be present (or very limited/low quality) in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R3 - Copper skink	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Suitable habitat for copper skink is not anticipated to be present (or very limited/low quality) in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R3 - Copper skink	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Suitable habitat for copper skink is not anticipated to be present (or very limited/low quality) in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low

NoR R4														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Construction	Noise/lighting/vibration/ dust	R4-Bat	Very High	Construction- Bats	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.)	Baseline. Upgrade of an existing road. No stream crossings. Important stream corridor (Mahurangi River tributaries) east and west of the NoR at the southern end, that is likely utilised by bats for foraging and commuting. Roosts may be present in adjacent native terrestrial vegetation. Bats likely to be disturbed by construction activities.	Indirect	Local	Short-term (<5 years)	Frequently	Likely	Totally	Low	Moderate
Operation	Presence of the road	R4-Bat	Very High	Operation- Bats	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	Baseline. Assume bat presence for native forest and treeland habitat. Proposed upgrades will cause additional fragmentation between existing SNAs to the south of the NOR. Potential cumulative effects due to proximity of Matakana and Sandspit Rd upgrades to SNAs. Upgrade of an existing road. No stream crossings. No additional fragmentation expected. Probability assessed as 'Likely' due to the presence of robust vegetation under baseline conditions Note: Extent (ZOI) changed to 'Local' as no additional fragmentation expected, to decrease Level of Effect from 'Moderate' to 'Low'. Mitigation light spill management around southern section during operation. No buffer planting required	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Moderate
Operation	Presence of the road	R4-Bat	Very High	Operation- Bats	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration	Baseline. Upgrade of an existing road. No stream crossings. Important stream corridor (Mahurangi River tributary) south of the NoR, but this is buffered by native terrestrial vegetation (MF4). Bats likely already habituated to road disturbance due to the existing road.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low
Construction	Noise/lighting/vibration/ dust	R4-Bat	Very High	Construction- Bats	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.)	Likely Future Ecological Environment. Bat habitat (particularly to the south of the NoR) will remain present in the FUZ. NoR is located in Future Urban Zone to the east, and Residential Zones to the west. Native vegetation on the east of Matakana Road is expected to be retained, however there is a buffer of Future Urban Zone between this vegetation and the NoR. Therefore bats are unlikely to be disturbed by construction activities in this environment.	Indirect	Local	Short-term (<5 years)	Frequently	Likely	Totally	Low	Moderate
Operation	Presence of the road	R4-Bat	Very High	Operation- Bats	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	Likely Future Ecological Environment. Bat habitat (particularly to the south of the NoR) will remain the FUZ. NoR is located in Future Urban Zone to the east, and Residential Zones to the west. No additional fragmentation is anticipated in this environment. Probability assessed as 'Likely' due to the presence of robust vegetation structure that will remain in the FUZ Note: Extent (ZOI) changed to 'Local' as no additional fragmentation expected, to decrease Level of Effect from 'Moderate' to 'Low'. Mitigation light spill management around southern section during operation. No buffer planting required	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Moderate
Operation	Presence of the road	R4-Bat	Very High	Operation- Bats	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration	Likely Future Ecological Environment. NoR is located in Future Urban Zone to the east, and Residential Zones to the west. NoR is an upgrade of an existing road. Bats unlikely to be disturbed by road activities in this environment.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low
Construction	Noise/lighting/vibration/ dust	R4 - Non-TAR bird	Low	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Upgrade of the existing Matakana Road. If birds are present, they are unlikely to be disturbed by construction activities (due to habituation to current conditions). The most conservative non-TAR species, such as grey warbler, has been used for this assessment.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R4 - Non-TAR bird	Low	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Upgrade of the existing Matakana Road. Existing baseline fragmentation (existing road and bridged/culverted streams) means that loss in connectivity resulting in changes to the population dynamics is unlikely.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low

NoR R4														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Operation	Presence of the road	R4 - Non-TAR bird	Low	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Upgrade of existing State Highway 1. If birds are present, they are unlikely to be disturbed by the presence of the road (due to habituation to current conditions).	Indirect	Local	Permanent (>25 years)	Continuously	Unlikely	Irreversible	Low	Very Low
Construction	Noise/lighting/vibration/ dust	R4 - Non-TAR bird	Low	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone to the east, and Residential Zones to the west. Native vegetation on the east of Matakana Road is expected to be retained, however there is an area of Future Urban Zone between this vegetation and the NoR. It is anticipated that birds present will be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R4 - Non-TAR bird	Low	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone to the east, and Residential Zones to the west. Native vegetation on the east of Matakana Road is expected to be retained, however there is an area of Future Urban Zone between this vegetation and the NoR. It is anticipated that the habitat will already be fragmented in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R4 - Non-TAR bird	Low	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone to the east, and Residential Zones to the west. Native vegetation on the east of Matakana Road is expected to be retained, however there is an area of Future Urban Zone between this vegetation and the NoR. It is anticipated that birds present will be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)	Continuously	Unlikely	Irreversible	Low	Very Low
Construction	Noise/lighting/vibration/ dust	R4 - New Zealand pipit	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. New Zealand pipit have the potential to utilise any open habitat such as Exotic Grassland and Exotic Scrub (EG is present in NoR R4). Note: 'Definite' likelihood assigned, as New Zealand pipit will require specific management during construction to prevent disturbance to nesting birds in the area.	Indirect	Local	Short-term (<5 years)	Frequently	Definite	Totally	Moderate	High
Operation	Presence of the road	R4 - New Zealand pipit	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. New Zealand pipit have the potential to utilise any open habitat such as Exotic Grassland and Exotic Scrub (EG is present in NoR R4). Effect is unlikely due to low densities of New Zealand pipit expected in the Zone of Influence.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R4 - New Zealand pipit	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. New Zealand pipit have the potential to utilise any open habitat such as Exotic Grassland and Exotic Scrub (EG is present in NoR R4). Effect is unlikely due to low densities of New Zealand pipit expected in the Zone of Influence.	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Very Low

NoR R4														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Construction	Noise/lighting/vibration/ dust	R4 - New Zealand pipit	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone to the east, and Residential Zones to the west. Native vegetation on the east of Matakana Road is expected to be retained, however there is an area of Future Urban Zone between this vegetation and the NoR. Suitable habitat for New Zealand pipit (EG, ES) is not anticipated to be present in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R4 - New Zealand pipit	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone to the east, and Residential Zones to the west. Native vegetation on the east of Matakana Road is expected to be retained, however there is an area of Future Urban Zone between this vegetation and the NoR. Suitable habitat for New Zealand pipit (EG, ES) is not anticipated to be present in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R4 - New Zealand pipit	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone to the east, and Residential Zones to the west. Native vegetation on the east of Matakana Road is expected to be retained, however there is an area of Future Urban Zone between this vegetation and the NoR. Suitable habitat for New Zealand pipit (EG, ES) is not anticipated to be present in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R4 - North Island kākā	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Kākā are considered a highly mobile species in this area, with seasonal use and high dispersal. Therefore they are unlikely to be disturbed by construction activities.	Indirect	Local	Short-term (<5 years)	Infrequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R4 - North Island kākā	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Existing baseline fragmentation (existing road and bridged streams) means that loss in connectivity resulting in changes to the population dynamics is unlikely.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R4 - North Island kākā	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Kākā are considered a highly mobile species in this area, with seasonal use and high dispersal. In addition, as the NoR is an upgrade of an existing road, it is expected that kākā would be habituated to road disturbance. Therefore they are unlikely to be disturbed by the presence of the road.	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R4 - North Island kākā	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone to the east, and Residential Zones to the west. Native vegetation on the east of Matakana Road is expected to be retained, however there is an area of Future Urban Zone between this vegetation and the NoR. In this environment, kākā are unlikely to be disturbed by construction activities. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Infrequently	Unlikely	Totally	Negligible	Very Low

NoR R4														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Operation	Presence of the road	R4 - North Island kākā	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone to the east, and Residential Zones to the west. Native vegetation on the east of Matakana Road is expected to be retained, however there is an area of Future Urban Zone between this vegetation and the NoR. It is expected that there would already be existing fragmentation in this environment, therefore loss in connectivity resulting in changes to the population dynamics is unlikely. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R4 - North Island kākā	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone to the east, and Residential Zones to the west. Native vegetation on the east of Matakana Road is expected to be retained, however there is an area of Future Urban Zone between this vegetation and the NoR. In this environment, and as the NoR is an upgrade of an existing road, it is expected that kākā would be habituated to road disturbance. Therefore they are unlikely to be disturbed by the presence of the road. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R4 - Long-tailed cuckoo	Very High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Long-tailed cuckoo are considered a highly mobile species in this area, with high dispersal. Therefore they are unlikely to be disturbed by construction activities.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Low
Operation	Presence of the road	R4 - Long-tailed cuckoo	Very High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Existing baseline fragmentation (existing road and bridged streams) means that loss in connectivity resulting in changes to the population dynamics is unlikely.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low
Operation	Presence of the road	R4 - Long-tailed cuckoo	Very High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Long-tailed cuckoo are considered a highly mobile species in this area, with high dispersal. In addition, as the NoR is an upgrade of an existing road, it is expected that long-tailed cuckoo would be habituated to road disturbance. Therefore they are unlikely to be disturbed by the presence of the road.	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Low
Construction	Noise/lighting/vibration/ dust	R4 - Long-tailed cuckoo	Very High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone to the east, and Residential Zones to the west. Native vegetation on the east of Matakana Road is expected to be retained, however there is an area of Future Urban Zone between this vegetation and the NoR. In this environment, long-tailed cuckoo are unlikely to be disturbed by construction activities. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Infrequently	Unlikely	Totally	Negligible	Low

NoR R4														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Operation	Presence of the road	R4 - Long-tailed cuckoo	Very High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone to the east, and Residential Zones to the west. Native vegetation on the east of Matakana Road is expected to be retained, however there is an area of Future Urban Zone between this vegetation and the NoR. It is expected that there would already be existing fragmentation in this environment, therefore loss in connectivity resulting in changes to the population dynamics is unlikely. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low
Operation	Presence of the road	R4 - Long-tailed cuckoo	Very High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone to the east, and Residential Zones to the west. Native vegetation on the east of Matakana Road is expected to be retained, however there is an area of Future Urban Zone between this vegetation and the NoR. In this environment, and as the NoR is an upgrade of an existing road, it is expected that long-tailed cuckoo would be habituated to road disturbance. Therefore they are unlikely to be disturbed by the presence of the road. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Low
Construction	Noise/lighting/vibration/ dust	R4 - Spotless crake	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Upgrade of the existing Matakana Road. Potential to utilise moderate to large sized wetlands (> 1000 m2) in the NoR (WW4-W1, WW4-W2) for foraging and nesting. Due to location of the proposed cut/fill areas in relation to wetlands WW4-W1 and WW4-W2, it is likely that birds using this habitat will be disturbed. Spotless crake are known to be in the wider area as they have been picked up in nearby acoustic surveys, and have the potential to be nesting in wetlands present in the NoR (M. Baber, personal communication, 27 January 2023). Note: A manual 'Moderate' level of effect has been assigned, as spotless crake will require specific management during construction to prevent disturbance to nesting birds in the area.	Indirect	Local	Short-term (<5 years)	Frequently	Highly Likely	Totally	Low	Moderate
Operation	Presence of the road	R4 - Spotless crake	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Upgrade of existing Matakana Road. Potential to utilise moderate to large sized wetlands (> 1000 m2) in the NoR (WW4-W1, WW4-W2) for foraging and nesting. However, spotless crake are considered to have 'good dispersal ability' (Cotter, 2016). Therefore loss in connectivity resulting in changes to the population dynamics is considered unlikely.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R4 - Spotless crake	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Upgrade of the existing Matakana Road. Potential to utilise moderate to large sized wetlands (> 1000 m2) in the NoR (WW4-W1, WW4-W2) for foraging and nesting. Spotless crake are known to be in the wider area as they have been picked up in nearby acoustic surveys, and have the potential to be nesting in wetlands present in the NoR (M. Baber, personal communication, 27 January 2023). Note: A manual 'Moderate' level of effect has been assigned, as spotless crake will require specific management to prevent disturbance to nesting birds in the area from the presence of the road.	Indirect	Local	Permanent (>25 years)	Periodically	Likely	Irreversible	Low	Moderate

NoR R4														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Construction	Noise/lighting/vibration/ dust	R4 - Spotless crake	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone to the east, and Residential Zones to the west. Native vegetation on the east of Matakana Road is expected to be retained, however there is an area of Future Urban Zone between this vegetation and the NoR. Delineated wetlands will be retained (and habitat quality likely improved) in the Likely Future Ecological Environment. Therefore there is higher potential for spotless crake to be foraging and nesting in this habitat, and could be disturbed by construction activities. Note: A manual 'Moderate' level of effect has been assigned, as spotless crake will require specific management during construction to prevent disturbance to nesting birds in the area.	Indirect	Local	Short-term (<5 years)	Frequently	Highly Likely	Totally	Low	Moderate
Operation	Presence of the road	R4 - Spotless crake	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone to the east, and Residential Zones to the west. Native vegetation on the east of Matakana Road is expected to be retained, however there is an area of Future Urban Zone between this vegetation and the NoR. Although it is anticipated that the delineated wetland will be retained, spotless crake are considered to have 'good dispersal ability' (Cotter, 2016). Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R4 - Spotless crake	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone to the east, and Residential Zones to the west. Native vegetation on the east of Matakana Road is expected to be retained, however there is an area of Future Urban Zone between this vegetation and the NoR. Delineated wetlands will be retained (and habitat quality likely improved) in the Likely Future Ecological Environment. Therefore there is higher potential for spotless crake to be foraging and nesting in this habitat, and could be disturbed by the presence of the road. Note: A manual 'Moderate' level of effect has been assigned, as spotless crake will require specific management to prevent disturbance to nesting birds in the area from the presence of the road.	Indirect	Local	Permanent (>25 years)	Periodically	Likely	Irreversible	Low	Moderate
Construction	Noise/lighting/vibration/ dust	R4 - Australasian bittern	Very High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Upgrade of the existing Matakana Road. Potential to utilise moderate to large sized wetlands (> 1000 m2) in the NoR (WW4-W1, WW4-W2) for foraging (unlikely to be nesting in this habitat). Due to location of the proposed cut/fill areas in relation to wetlands WW4-W1 and WW4-W2, it is likely that birds using this habitat will be disturbed. However, Australasian bittern are considered a highly mobile species in this area, with high dispersal. Therefore, it is unlikely that construction disturbance will result in changes to the population dynamics.	Indirect	Local	Short-term (<5 years)	Infrequently	Unlikely	Totally	Negligible	Low
Operation	Presence of the road	R4 - Australasian bittern	Very High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Upgrade of the existing Matakana Road. Potential to utilise moderate to large sized wetlands (> 1000 m2) in the NoR (WW4-W1, WW4-W2) for foraging (unlikely to be nesting in this habitat). As Australasian bittern are considered a highly mobile species in this area, with high dispersal, a loss in connectivity that results in changes to the population dynamics is considered unlikely.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low

NoR R4														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Operation	Presence of the road	R4 - Australasian bittern	Very High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Upgrade of the existing Matakana Road. Potential to utilise moderate to large sized wetlands (> 1000 m2) in the NoR (WW4-W1, WW4-W2) for foraging (unlikely to be nesting in this habitat). Due to the existing disturbance from SH1, it is unlikely that disturbance from the presence of the road will result in changes to the population dynamics.	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Low
Construction	Noise/lighting/vibration/ dust	R4 - Australasian bittern	Very High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone to the east, and Residential Zones to the west. Native vegetation on the east of Matakana Road is expected to be retained, however there is an area of Future Urban Zone between this vegetation and the NoR. Australasian bittern are considered a mobile species in this area, with high dispersal, and unlikely to be nesting. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Low
Operation	Presence of the road	R4 - Australasian bittern	Very High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone to the east, and Residential Zones to the west. Native vegetation on the east of Matakana Road is expected to be retained, however there is an area of Future Urban Zone between this vegetation and the NoR. Australasian bittern are considered a mobile species in this area, with high dispersal, and unlikely to be nesting. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low
Operation	Presence of the road	R4 - Australasian bittern	Very High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone to the east, and Residential Zones to the west. Native vegetation on the east of Matakana Road is expected to be retained, however there is an area of Future Urban Zone between this vegetation and the NoR. Australasian bittern are considered a mobile species in this area, with high dispersal, and unlikely to be nesting. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Low
Construction	Noise/lighting/vibration/ dust	R4 - Copper skink	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. As the NoR is an upgrade of existing road, disturbance to copper skink resulting in changes to the population dynamics is considered unlikely (due to habituation to existing disturbance).	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R4 - Copper skink	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. As the NoR is an upgrade of existing road, loss in connectivity for copper skink resulting in changes to the population dynamics is considered unlikely due to the their 'small home range' (New Zealand Herpetological Society, 2022).	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R4 - Copper skink	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Baseline. As the NoR is an upgrade of existing road, disturbance to copper skink resulting in changes to the population dynamics is considered unlikely (due to habituation to existing disturbance).	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R4 - Copper skink	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone to the east, and Residential Zones to the west. Native vegetation on the east of Matakana Road is expected to be retained, however there is an area of Future Urban Zone between this vegetation and the NoR. Suitable habitat for copper skink is not anticipated to be present (or very limited/low quality) in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low

NoR R4														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Operation	Presence of the road	R4 - Copper skink	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone to the east, and Residential Zones to the west. Native vegetation on the east of Matakana Road is expected to be retained, however there is an area of Future Urban Zone between this vegetation and the NoR. Suitable habitat for copper skink is not anticipated to be present (or very limited/low quality) in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R4 - Copper skink	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone to the east, and Residential Zones to the west. Native vegetation on the east of Matakana Road is expected to be retained, however there is an area of Future Urban Zone between this vegetation and the NoR. Suitable habitat for copper skink is not anticipated to be present (or very limited/low quality) in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R4 - Ornate skink	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. As the NoR is an upgrade of existing road, disturbance to ornate skink resulting in changes to the population dynamics is considered unlikely (due to habituation to existing disturbance).	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R4 - Ornate skink	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. As the NoR is an upgrade of existing road, loss in connectivity for ornate skink resulting in changes to the population dynamics is considered unlikely due to the their 'small home range, often of only a few metres if the habitat is suitable' (Taranaki Regional Council, 2022).	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R4 - Ornate skink	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Baseline. As the NoR is an upgrade of existing road, disturbance to ornate skink resulting in changes to the population dynamics is considered unlikely (due to habituation to existing disturbance).	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R4 - Ornate skink	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone to the east, and Residential Zones to the west. Native vegetation on the east of Matakana Road is expected to be retained, however there is an area of Future Urban Zone between this vegetation and the NoR. Suitable habitat for ornate skink is not anticipated to be present (or very limited/low quality) in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R4 - Ornate skink	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone to the east, and Residential Zones to the west. Native vegetation on the east of Matakana Road is expected to be retained, however there is an area of Future Urban Zone between this vegetation and the NoR. Suitable habitat for ornate skink is not anticipated to be present (or very limited/low quality) in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low

NoR R4													
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Operation	Presence of the road	R4 - Ornate skink	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone to the east, and Residential Zones to the west. Native vegetation on the east of Matakana Road is expected to be retained, however there is an area of Future Urban Zone between this vegetation and the NoR. Suitable habitat for ornate skink is not anticipated to be present (or very limited/low quality) in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R4 - Elegant gecko and forest gecko	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Arboreal gecko species are expected to utilise the large stands of native terrestrial vegetation (WF13, MF4, and VS2) that are present within the southern section of the NoR. As they are nocturnal species, it is likely that they are highly sensitive to construction disturbance, particularly construction lighting at night.	Indirect	Local	Short-term (<5 years)	Frequently	Likely	Totally	Low	Low
Operation	Presence of the road	R4 - Elegant gecko and forest gecko	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Although data is limited on the home range of geckos, it is unlikely that a loss in connectivity that results in changes to the population dynamics will occur, due to the limited habitat loss that will occur. There will be some loss of WF13 (western side of Matakana Road), MF4, and VS2 (eastern side of Matakana Road). However, the majority of these habitats will not be impacted.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R4 - Elegant gecko and forest gecko	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Baseline. Arboreal gecko species are expected to utilise the large stands of native terrestrial vegetation (WF13, MF4, and VS2) that are present within the southern section of the NoR. As they are nocturnal species, it is likely that they are sensitive to lighting at night. However, as the NoR is an upgrade of an existing road, it is expected that these species would already be habituated to disturbance from the presence of the road.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R4 - Elegant gecko and forest gecko	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone to the east, and Residential Zones to the west. Native vegetation on the east of Matakana Road is expected to be retained, however there is an area of Future Urban Zone between this vegetation and the NoR. Although it is anticipated that suitable gecko habitat will be retained in the buffer of the permanent streams and in adjacent SEAs, it is expected that gecko will already be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R4 - Elegant gecko and forest gecko	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone to the east, and Residential Zones to the west. Native vegetation on the east of Matakana Road is expected to be retained, however there is an area of Future Urban Zone between this vegetation and the NoR. Although it is anticipated that suitable gecko habitat will be retained in the buffer of the permanent streams and in adjacent SEAs, the upgrade of the existing road is not expected to impact the remaining suitable habitat in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low

NoR R4														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Operation	Presence of the road	R4 - Elegant gecko and forest gecko	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone to the east, and Residential Zones to the west. Native vegetation on the east of Matakana Road is expected to be retained, however there is an area of Future Urban Zone between this vegetation and the NoR. Although it is anticipated that suitable gecko habitat will be retained in the buffer of the permanent streams and in adjacent SEAs, it is expected that gecko will already be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R4 - Pacific gecko	Moderate	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Arboreal gecko species are expected to utilise the large stands of native terrestrial vegetation (WF13, MF4, and VS2) that are present within the southern section of the NoR. As they are nocturnal species, it is likely that they are highly sensitive to construction disturbance, particularly construction lighting at night.	Indirect	Local	Short-term (<5 years)	Frequently	Likely	Totally	Low	Low
Operation	Presence of the road	R4 - Pacific gecko	Moderate	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Although data is limited on the home range of geckos, it is unlikely that a loss in connectivity that results in changes to the population dynamics will occur, due to the limited habitat loss that will occur. There will be some loss of WF13 (western side of Matakana Road), MF4, and VS2 (eastern side of Matakana Road). However, the majority of these habitats will not be impacted.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R4 - Pacific gecko	Moderate	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Baseline. Arboreal gecko species are expected to utilise the large stands of native terrestrial vegetation (WF13, MF4, and VS2) that are present within the southern section of the NoR. As they are nocturnal species, it is likely that they are sensitive to lighting at night. However, as the NoR is an upgrade of an existing road, it is expected that these species would already be habituated to disturbance from the presence of the road.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R4 - Pacific gecko	Moderate	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone to the east, and Residential Zones to the west. Native vegetation on the east of Matakana Road is expected to be retained, however there is an area of Future Urban Zone between this vegetation and the NoR. Although it is anticipated that suitable gecko habitat will be retained in the buffer of the permanent streams and in adjacent SEAs, it is expected that gecko will already be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R4 - Pacific gecko	Moderate	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone to the east, and Residential Zones to the west. Native vegetation on the east of Matakana Road is expected to be retained, however there is an area of Future Urban Zone between this vegetation and the NoR. Although it is anticipated that suitable gecko habitat will be retained in the buffer of the permanent streams and in adjacent SEAs, the upgrade of the existing road is not expected to impact the remaining suitable habitat in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low

NoR R4														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Operation	Presence of the road	R4 - Pacific gecko	Moderate	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone to the east, and Residential Zones to the west. Native vegetation on the east of Matakana Road is expected to be retained, however there is an area of Future Urban Zone between this vegetation and the NoR. Although it is anticipated that suitable gecko habitat will be retained in the buffer of the permanent streams and in adjacent SEAs, it is expected that gecko will already be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R4 - Hochstetter's frog	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Upgrade of existing Matakana Road. Hochstetter's frog populations may be present in the permanent streams in the southern section of the NoR (near the Matakana Road/Sandspit Road intersection). Due to their nocturnal nature, it is expected that Hochstetter's frog will be highly sensitive to construction activities, particularly lighting at night. However, as the existing Sandspit Road is located between the NoR and WW5-S1, and the area of WF13 (that is also a SEA) acts as a buffer between the existing Matakana Road and the permanent stream south of the NoR, it is unlikely that any disturbance to Hochstetter's frog populations present won't will result in changes in the population dynamics.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R4 - Hochstetter's frog	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Upgrade of existing Matakana Road. No streams will be impacted in the southern section of the NoR. Therefore, loss in connectivity is considered unlikely.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R4 - Hochstetter's frog	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Baseline. Upgrade of existing Matakana Road. Hochstetter's frog populations may be present in the permanent streams in the southern section of the NoR (near the Matakana Road/Sandspit Road intersection). Due to their nocturnal nature, it is expected that Hochstetter's frog will be highly sensitive to disturbance from the road, particularly lighting at night. However, as the existing Sandspit Road is located between the NoR and WW5-S1, and the area of WF13 (that is also a SEA) acts as a buffer between the existing Matakana Road and the permanent stream south of the NoR, it is unlikely that any disturbance to Hochstetter's frog populations present won't result in changes in the population dynamics.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R4 - Hochstetter's frog	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone to the east, and Residential Zones to the west. Native vegetation on the east of Matakana Road is expected to be retained, however there is an area of Future Urban Zone between this vegetation and the NoR. It is expected that any populations present would be habituated to disturbance in this environment, therefore it is not anticipated that disturbance to Hochstetter's frogs will result in changes to the population dynamics. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low

NoR R4														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Operation	Presence of the road	R4 - Hochstetter's frog	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone to the east, and Residential Zones to the west. Native vegetation on the east of Matakana Road is expected to be retained, however there is an area of Future Urban Zone between this vegetation and the NoR. It is anticipated that there would be existing fragmentation in this environment. Therefore, the magnitude and level of effect are considered lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R4 - Hochstetter's frog	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone to the east, and Residential Zones to the west. Native vegetation on the east of Matakana Road is expected to be retained, however there is an area of Future Urban Zone between this vegetation and the NoR. It is expected that any populations present would be habituated to disturbance in this environment, therefore it is not anticipated that disturbance to Hochstetter's frogs will result in changes to the population dynamics. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low

NoR R5														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Construction	Noise/lighting/vibration/ dust	R5-Bat	Very High	Construction- Bats	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.)	Baseline. Upgrade of existing road, including two stream crossings of important stream corridor (Mahurangi River tributary), likely utilised for bats for foraging and commuting. Roosts also likely to be present in associated native vegetation. Bats highly likely to be disturbed by construction activities due to close proximity to bat corridor and potential roosts.	Indirect	Local	Short-term (<5 years)	Frequently	Likely	Totally	Low	Moderate
Operation	Presence of the road	R5-Bat	Very High	Operation- Bats	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	Baseline. Two stream crossings of important stream corridor (Mahurangi River tributary). Although it is an upgrade of an existing road, and these crossings are already bridged, additional fragmentation may occur.	Indirect	Regional	Permanent (>25 years)		Unlikely	Irreversible	Low	Moderate
Operation	Presence of the road	R5-Bat	Very High	Operation- Bats	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration	Baseline. Upgrade of existing road. It is anticipated that bats in the area are already habituated to road disturbance due the existing road.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low
Construction	Noise/lighting/vibration/ dust	R5-Bat	Very High	Construction- Bats	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.)	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Native vegetation on the east of Sandspit Road (on the eastern side of the Mahurangi River tributary) is expected to be retained, however there is an area of Future Urban Zone between this vegetation throughout most of the NoR. There is one area of native vegetation south of Withers Lane that will be retained with no area of Future Urban Zone. Due to the importance of this stream corridor for bats, it is anticipated that bats could be disturbed by construction activities in this area of the NoR.	Indirect	Local	Short-term (<5 years)	Frequently	Likely	Totally	Low	Moderate
Operation	Presence of the road	R5-Bat	Very High	Operation- Bats	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Although it is an upgrade of an existing road, it is expected that the Mahurangi River tributary and associated native vegetation to the east of the tributary will be retained, and the importance of the tributary as a corridor for bats will be increased due to the development in the area. Additional fragmentation is expected to occur.	Indirect	Regional	Permanent (>25 years)		Unlikely	Irreversible	Low	Moderate
Operation	Presence of the road	R5-Bat	Very High	Operation- Bats	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration	Likely Future Ecological Environment. NoR is located in Future Urban Zone and is an upgrade of an existing road. Bats unlikely to be disturbed by the presence of the road in this environment.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low
Construction	Noise/lighting/vibration/ dust	R5 - Non-TAR bird	Low	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Upgrade of the existing Sandspit Road. If birds are present, they are unlikely to be disturbed by construction activities (due to habituation to current conditions). The most conservative non-TAR species, such as grey warbler, has been used for this assessment.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R5 - Non-TAR bird	Low	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Upgrade of the existing Sandspit Road. Existing baseline fragmentation (existing road and bridged/culverted streams) means that loss in connectivity resulting in changes to the population dynamics is unlikely.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R5 - Non-TAR bird	Low	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Upgrade of the existing Sandspit Road. If birds are present, they are unlikely to be disturbed by the presence of the road (due to habituation to current conditions).	Indirect	Local	Permanent (>25 years)	Continuously	Unlikely	Irreversible	Low	Very Low

NoR R5														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Construction	Noise/lighting/vibration/ dust	R5 - Non-TAR bird	Low	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Native vegetation on the east of Sandspit Road (on the eastern side of the Mahurangi River tributary) is expected to be retained, however there is an area of Future Urban Zone between this vegetation throughout most of the NoR. It is anticipated that birds present will be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R5 - Non-TAR bird	Low	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Native vegetation on the east of Sandspit Road (on the eastern side of the Mahurangi River tributary) is expected to be retained, however there is an area of Future Urban Zone between this vegetation throughout most of the NoR. It is anticipated that the habitat will already be fragmented in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R5 - Non-TAR bird	Low	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Native vegetation on the east of Sandspit Road (on the eastern side of the Mahurangi River tributary) is expected to be retained, however there is an area of Future Urban Zone between this vegetation throughout most of the NoR. It is anticipated that birds present will be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)	Continuously	Unlikely	Irreversible	Low	Very Low
Construction	Noise/lighting/vibration/ dust	R5 - New Zealand pipit	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. New Zealand pipit have the potential to utilise any open habitat such as Exotic Grassland and Exotic Scrub (both present in NoR R5). Note: 'Definite' likelihood assigned, as New Zealand pipit will require specific management during construction to prevent disturbance to nesting birds in the area.	Indirect	Local	Short-term (<5 years)	Frequently	Definite	Totally	Moderate	High
Operation	Presence of the road	R5 - New Zealand pipit	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. New Zealand pipit have the potential to utilise any open habitat such as Exotic Grassland and Exotic Scrub (both present in NoR R5). Effect is unlikely due to low densities of New Zealand pipit expected in the Zone of Influence.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R5 - New Zealand pipit	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. New Zealand pipit have the potential to utilise any open habitat such as Exotic Grassland and Exotic Scrub (both present in NoR R5). Effect is unlikely due to low densities of New Zealand pipit expected in the Zone of Influence.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R5 - New Zealand pipit	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Suitable habitat for New Zealand pipit (EG, ES) is not anticipated to be present in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low

NoR R5														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Operation	Presence of the road	R5 - New Zealand pipit	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Suitable habitat for New Zealand pipit (EG, ES) is not anticipated to be present in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R5 - New Zealand pipit	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Suitable habitat for New Zealand pipit (EG, ES) is not anticipated to be present in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R5 - North Island kākā	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Kākā are considered a highly mobile species in this area, with seasonal use and high dispersal. Therefore they are unlikely to be disturbed by construction activities.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R5 - North Island kākā	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Existing baseline fragmentation (existing road and bridged streams) means that loss in connectivity resulting in changes to the population dynamics is unlikely.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R5 - North Island kākā	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Kākā are considered a highly mobile species in this area, with seasonal use and high dispersal. In addition, as the NoR is an upgrade of an existing road, it is expected that kākā would be habituated to road disturbance. Therefore they are unlikely to be disturbed by the presence of the road.	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R5 - North Island kākā	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Native vegetation on the east of Sandspit Road (on the eastern side of the Mahurangi River tributary) is expected to be retained, however there is an area of Future Urban Zone between this vegetation throughout most of the NoR. In this environment, kākā are unlikely to be disturbed by construction activities. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Infrequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R5 - North Island kākā	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Native vegetation on the east of Sandspit Road (on the eastern side of the Mahurangi River tributary) is expected to be retained, however there is an area of Future Urban Zone between this vegetation throughout most of the NoR. It is expected that there would already be existing fragmentation in this environment, therefore loss in connectivity resulting in changes to the population dynamics is unlikely. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low

NoR R5														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Operation	Presence of the road	R5 - North Island kākā	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Native vegetation on the east of Sandspit Road (on the eastern side of the Mahurangi River tributary) is expected to be retained, however there is an area of Future Urban Zone between this vegetation throughout most of the NoR. In this environment, and as the NoR is an upgrade of an existing road, it is expected that kākā would be habituated to road disturbance. Therefore they are unlikely to be disturbed by the presence of the road. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R5 - Long-tailed cuckoo	Very High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Long-tailed cuckoo are considered a highly mobile species in this area, with high dispersal. Therefore they are unlikely to be disturbed by construction activities.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Low
Operation	Presence of the road	R5 - Long-tailed cuckoo	Very High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Existing baseline fragmentation (existing road and bridged streams) means that loss in connectivity resulting in changes to the population dynamics is unlikely.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low
Operation	Presence of the road	R5 - Long-tailed cuckoo	Very High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Long-tailed cuckoo are considered a highly mobile species in this area, with high dispersal. In addition, as the NoR is an upgrade of an existing road, it is expected that long-tailed cuckoo would be habituated to road disturbance. Therefore they are unlikely to be disturbed by the presence of the road.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low
Construction	Noise/lighting/vibration/ dust	R5 - Long-tailed cuckoo	Very High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Native vegetation on the east of Sandspit Road (on the eastern side of the Mahurangi River tributary) is expected to be retained, however there is an area of Future Urban Zone between this vegetation throughout most of the NoR. In this environment, long-tailed cuckoo are unlikely to be disturbed by construction activities. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Low
Operation	Presence of the road	R5 - Long-tailed cuckoo	Very High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Native vegetation on the east of Sandspit Road (on the eastern side of the Mahurangi River tributary) is expected to be retained, however there is an area of Future Urban Zone between this vegetation throughout most of the NoR. It is expected that there would already be existing fragmentation in this environment, therefore loss in connectivity resulting in changes to the population dynamics is unlikely. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low
Operation	Presence of the road	R5 - Long-tailed cuckoo	Very High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Native vegetation on the east of Sandspit Road (on the eastern side of the Mahurangi River tributary) is expected to be retained, however there is an area of Future Urban Zone between this vegetation throughout most of the NoR. In this environment, and as the NoR is an upgrade of an existing road, it is expected that long-tailed cuckoo would be habituated to road disturbance. Therefore they are unlikely to be disturbed by the presence of the road. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)	Frequently	Unlikely	Irreversible	Negligible	Low

NoR R5														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Construction	Noise/lighting/vibration/ dust	R5 - Spotless crake	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Upgrade of the existing Sandspit Road. Potential to utilise moderate to large sized wetlands (> 3000 m2) in the NoR (WW5-W2, WW5-W3) for foraging and nesting. Spotless crake are known to be in the wider area as they have been picked up in nearby acoustic surveys, and have the potential to be nesting in wetlands present in the NoR (M. Baber, personal communication, 27 January 2023). Note: A manual 'Moderate' level of effect has been assigned, as spotless crake will require specific management during construction to prevent disturbance to nesting birds in the area.	Indirect	Local	Short-term (<5 years)	Frequently	Highly Likely	Totally	Low	Moderate
Operation	Presence of the road	R5 - Spotless crake	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Upgrade of the existing Sandspit Road. Potential to utilise moderate to large sized wetlands (> 3000 m2) in the NoR (WW5-W2, WW5-W3) for foraging and nesting. However, spotless crake are considered to have 'good dispersal ability' (Cotter, 2016). Therefore loss in connectivity resulting in changes to the population dynamics is considered unlikely.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R5 - Spotless crake	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Upgrade of the existing Sandspit Road. Potential to utilise moderate to large sized wetlands (> 3000 m2) in the NoR (WW5-W2, WW5-W3) for foraging and nesting. Spotless crake are known to be in the wider area as they have been picked up in nearby acoustic surveys, and have the potential to be nesting in wetlands present in the NoR (M. Baber, personal communication, 27 January 2023). Note: A manual 'Moderate' level of effect has been assigned, as spotless crake will require specific management to prevent disturbance to nesting birds in the area from the presence of the road.	Indirect	Local	Permanent (>25 years)	Frequently	Likely	Irreversible	Low	Moderate
Construction	Noise/lighting/vibration/ dust	R5 - Spotless crake	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Native vegetation on the east of Sandspit Road (on the eastern side of the Mahurangi River tributary) is expected to be retained, however there is an area of Future Urban Zone between this vegetation throughout most of the NoR. Delineated wetlands will be retained (and habitat quality likely improved) in the Likely Future Ecological Environment. Therefore there is higher potential for spotless crake to be foraging and nesting in this habitat, and could be disturbed by construction activities. Note: A manual 'Moderate' level of effect has been assigned, as spotless crake will require specific management during construction to prevent disturbance to nesting birds in the area.	Indirect	Local	Short-term (<5 years)	Frequently	Highly Likely	Totally	Low	Moderate
Operation	Presence of the road	R5 - Spotless crake	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Native vegetation on the east of Sandspit Road (on the eastern side of the Mahurangi River tributary) is expected to be retained, however there is an area of Future Urban Zone between this vegetation throughout most of the NoR. Although it is anticipated that the delineated wetland will be retained, spotless crake are considered to have 'good dispersal ability' (Cotter, 2016). Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low

NoR R5														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Operation	Presence of the road	R5 - Spotless crake	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Native vegetation on the east of Sandspit Road (on the eastern side of the Mahurangi River tributary) is expected to be retained, however there is an area of Future Urban Zone between this vegetation throughout most of the NoR. Delineated wetlands will be retained (and habitat quality likely improved) in the Likely Future Ecological Environment. Therefore there is higher potential for spotless crake to be foraging and nesting in this habitat, and could be disturbed by the presence of the road. Note: A manual 'Moderate' level of effect has been assigned, as spotless crake will require specific management to prevent disturbance to nesting birds in the area from the presence of the road.	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Moderate
Construction	Noise/lighting/vibration/ dust	R5 - Australasian bittern	Very High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Upgrade of the existing Sandspit Road. Potential to utilise moderate to large sized wetlands (> 3000 m2) in the NoR (WW5-W2, WW5-W3) for foraging (unlikely to be nesting in this habitat). Australasian bittern are considered a highly mobile species in this area, with high dispersal. Therefore, it is unlikely that construction disturbance will result in changes to the population dynamics.	Indirect	Local	Short-term (<5 years)	Infrequently	Unlikely	Totally	Negligible	Low
Operation	Presence of the road	R5 - Australasian bittern	Very High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Upgrade of the existing Sandspit Road. Potential to utilise moderate to large sized wetlands (> 3000 m2) in the NoR (WW5-W2, WW5-W3) for foraging (unlikely to be nesting in this habitat). As Australasian bittern are considered a highly mobile species in this area, with high dispersal, a loss in connectivity that results in changes to the population dynamics is considered unlikely.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low
Operation	Presence of the road	R5 - Australasian bittern	Very High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Upgrade of the existing Sandspit Road. Potential to utilise moderate to large sized wetlands (> 3000 m2) in the NoR (WW5-W2, WW5-W3) for foraging (unlikely to be nesting in this habitat). Due to the existing disturbance from Sandspit Road, it is unlikely that disturbance from the presence of the road will result in changes to the population dynamics.	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Low
Construction	Noise/lighting/vibration/ dust	R5 - Australasian bittern	Very High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Native vegetation on the east of Sandspit Road (on the eastern side of the Mahurangi River tributary) is expected to be retained, however there is an area of Future Urban Zone between this vegetation throughout most of the NoR. Australasian bittern are considered a mobile species in this area, with high dispersal, and unlikely to be nesting. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Infrequently	Unlikely	Totally	Negligible	Low
Operation	Presence of the road	R5 - Australasian bittern	Very High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Native vegetation on the east of Sandspit Road (on the eastern side of the Mahurangi River tributary) is expected to be retained, however there is an area of Future Urban Zone between this vegetation throughout most of the NoR. Australasian bittern are considered a mobile species in this area, with high dispersal, and unlikely to be nesting. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low

NoR R5														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Operation	Presence of the road	R5 - Australasian bittern	Very High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Native vegetation on the east of Sandspit Road (on the eastern side of the Mahurangi River tributary) is expected to be retained, however there is an area of Future Urban Zone between this vegetation throughout most of the NoR. Australasian bittern are considered a mobile species in this area, with high dispersal, and unlikely to be nesting. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Low
Construction	Noise/lighting/vibration/ dust	R5 - Copper skink	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Upgrade of existing Sandspit Road. As the NoR is an upgrade of existing road, disturbance to copper skink resulting in changes to the population dynamics is considered unlikely (due to habituation to existing disturbance).	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R5 - Copper skink	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Upgrade of existing Sandspit Road. As the NoR is an upgrade of existing road, loss in connectivity for copper skink resulting in changes to the population dynamics is considered unlikely due to the their 'small home range' (New Zealand Herpetological Society, 2022).	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R5 - Copper skink	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Baseline. Upgrade of existing Sandspit Road. As the NoR is an upgrade of existing road, disturbance to copper skink resulting in changes to the population dynamics is considered unlikely (due to habituation to existing disturbance).	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R5 - Copper skink	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Native vegetation on the east of Sandspit Road (on the eastern side of the Mahurangi River tributary) is expected to be retained, however there is an area of Future Urban Zone between this vegetation throughout most of the NoR. Suitable habitat for copper skink is not anticipated to be present (or very limited/low quality) in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R5 - Copper skink	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Native vegetation on the east of Sandspit Road (on the eastern side of the Mahurangi River tributary) is expected to be retained, however there is an area of Future Urban Zone between this vegetation throughout most of the NoR. Suitable habitat for copper skink is not anticipated to be present (or very limited/low quality) in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R5 - Copper skink	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Native vegetation on the east of Sandspit Road (on the eastern side of the Mahurangi River tributary) is expected to be retained, however there is an area of Future Urban Zone between this vegetation throughout most of the NoR. Suitable habitat for copper skink is not anticipated to be present (or very limited/low quality) in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low

NoR R5														
Phase	**Project Activity**	**Resource Unit (Habitat/Species)**	**Ecological Value**	**Effect Description Main**	**Effect Description Detailed**	**Effects Description Manual**	**Type**	**Extent (ZOI)**	**Duration**	**Frequency**	**Likelihood**	**Reversibility**	**Magnitude (pre-mitigation)**	**Level of Effect (Pre-mitigation)**
Construction	Noise/lighting/vibration/ dust	R5 - Ornate skink	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Upgrade of existing Sandspit Road. As the NoR is an upgrade of existing road, disturbance to ornate skink resulting in changes to the population dynamics is considered unlikely (due to habituation to existing disturbance).	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R5 - Ornate skink	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Upgrade of existing Sandspit Road. As the NoR is an upgrade of existing road, loss in connectivity for ornate skink resulting in changes to the population dynamics is considered unlikely due to the their 'small home range, often of only a few metres if the habitat is suitable' (Taranaki Regional Council, 2022).	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R5 - Ornate skink	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Baseline. Upgrade of existing Sandspit Road. As the NoR is an upgrade of existing road, disturbance to ornate skink resulting in changes to the population dynamics is considered unlikely (due to habituation to existing disturbance).	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R5 - Ornate skink	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Native vegetation on the east of Sandspit Road (on the eastern side of the Mahurangi River tributary) is expected to be retained, however there is an area of Future Urban Zone between this vegetation throughout most of the NoR. Suitable habitat for ornate skink is not anticipated to be present (or very limited/low quality) in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R5 - Ornate skink	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Native vegetation on the east of Sandspit Road (on the eastern side of the Mahurangi River tributary) is expected to be retained, however there is an area of Future Urban Zone between this vegetation throughout most of the NoR. Suitable habitat for ornate skink is not anticipated to be present (or very limited/low quality) in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R5 - Ornate skink	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Native vegetation on the east of Sandspit Road (on the eastern side of the Mahurangi River tributary) is expected to be retained, however there is an area of Future Urban Zone between this vegetation throughout most of the NoR. Suitable habitat for ornate skink is not anticipated to be present (or very limited/low quality) in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R5 - Elegant gecko and forest gecko	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Upgrade of existing Sandspit Road. Arboreal gecko species are expected to utilise the large stands of native terrestrial vegetation (VS2, MF4, WF11), and potentially large areas of TL.2 and EF that are present within the NoR. As they are nocturnal species, it is likely that they are highly sensitive to construction disturbance, particularly construction lighting at night.	Indirect	Local	Short-term (<5 years)	Frequently	Likely	Totally	Low	Low

NoR R5														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Operation	Presence of the road	R5 - Elegant gecko and forest gecko	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Upgrade of existing Sandspit Road. Although data is limited on the home range of geckos, it is unlikely that a loss in connectivity that results in changes to the population dynamics will occur, due to the limited habitat loss that will occur. There will be some loss of TL.2, WF11, and EF). However, the majority of these habitats will not be impacted.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R5 - Elegant gecko and forest gecko	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Baseline. Upgrade of existing Sandspit Road. Arboreal gecko species are expected to utilise the large stands of native terrestrial vegetation (VS2, MF4, WF11), and potentially large areas of TL.2 and EF that are present within the southern section of the NoR. As they are nocturnal species, it is likely that they are sensitive to lighting at night. However, as the NoR is an upgrade of an existing road, it is expected that these species would already be habituated to disturbance from the presence of the road.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R5 - Elegant gecko and forest gecko	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Native vegetation on the east of Sandspit Road (on the eastern side of the Mahurangi River tributary) is expected to be retained, however there is an area of Future Urban Zone between this vegetation throughout most of the NoR. Although it is anticipated that suitable gecko habitat will be retained in the buffer of the permanent streams and in adjacent SEAs, it is expected that gecko will already be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R5 - Elegant gecko and forest gecko	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Native vegetation on the east of Sandspit Road (on the eastern side of the Mahurangi River tributary) is expected to be retained, however there is an area of Future Urban Zone between this vegetation throughout most of the NoR. Although it is anticipated that suitable gecko habitat will be retained in the buffer of the permanent streams and in adjacent SEAs, the upgrade of the existing road is not expected to impact the remaining suitable habitat in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R5 - Elegant gecko and forest gecko	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Native vegetation on the east of Sandspit Road (on the eastern side of the Mahurangi River tributary) is expected to be retained, however there is an area of Future Urban Zone between this vegetation throughout most of the NoR. Although it is anticipated that suitable gecko habitat will be retained in the buffer of the permanent streams and in adjacent SEAs, it is expected that gecko will already be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R5 - Pacific gecko	Moderate	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Upgrade of existing Sandspit Road. Arboreal gecko species are expected to utilise the large stands of native terrestrial vegetation (VS2, MF4, WF11), and potentially large areas of TL.2 and EF that are present within the the NoR. As they are nocturnal species, it is likely that they are highly sensitive to construction disturbance, particularly construction lighting at night.	Indirect	Local	Short-term (<5 years)	Frequently	Likely	Totally	Low	Low

NoR R5														
Phase	**Project Activity**	**Resource Unit (Habitat/Species)**	**Ecological Value**	**Effect Description Main**	**Effect Description Detailed**	**Effects Description Manual**	**Type**	**Extent (ZOI)**	**Duration**	**Frequency**	**Likelihood**	**Reversibility**	**Magnitude (pre-mitigation)**	**Level of Effect (Pre-mitigation)**
Operation	Presence of the road	R5 - Pacific gecko	Moderate	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Upgrade of existing Sandspit Road. Although data is limited on the home range of geckos, it is unlikely that a loss in connectivity that results in changes to the population dynamics will occur, due to the limited habitat loss that will occur. There will be some loss of TL.2, WF11, and EF). However, the majority of these habitats will not be impacted.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R5 - Pacific gecko	Moderate	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Baseline. Upgrade of existing Sandspit Road. Arboreal gecko species are expected to utilise the large stands of native terrestrial vegetation (VS2, MF4, WF11), and potentially large areas of TL.2 and EF that are present within the southern section of the NoR. As they are nocturnal species, it is likely that they are sensitive to lighting at night. However, as the NoR is an upgrade of an existing road, it is expected that these species would already be habituated to disturbance from the presence of the road.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R5 - Pacific gecko	Moderate	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Native vegetation on the east of Sandspit Road (on the eastern side of the Mahurangi River tributary) is expected to be retained, however there is an area of Future Urban Zone between this vegetation throughout most of the NoR. Although it is anticipated that suitable gecko habitat will be retained in the buffer of the permanent streams and in adjacent SEAs, it is expected that gecko will already be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R5 - Pacific gecko	Moderate	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Native vegetation on the east of Sandspit Road (on the eastern side of the Mahurangi River tributary) is expected to be retained, however there is an area of Future Urban Zone between this vegetation throughout most of the NoR. Although it is anticipated that suitable gecko habitat will be retained in the buffer of the permanent streams and in adjacent SEAs, the upgrade of the existing road is not expected to impact the remaining suitable habitat in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R5 - Pacific gecko	Moderate	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Native vegetation on the east of Sandspit Road (on the eastern side of the Mahurangi River tributary) is expected to be retained, however there is an area of Future Urban Zone between this vegetation throughout most of the NoR. Although it is anticipated that suitable gecko habitat will be retained in the buffer of the permanent streams and in adjacent SEAs, it is expected that gecko will already be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low

NoR R5														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Construction	Noise/lighting/vibration/ dust	R5 - Hochstetter's frog	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Upgrade of existing Sandspit Road. Hochstetter's frog populations may be present in the permanent streams in the southern section of the NoR (near the Matakana Road/Sandspit Road intersection). Due to their nocturnal nature, it is expected that Hochstetter's frog will be highly sensitive to construction activities, particularly lighting at night. WW5-S1 will be directly impacted by the NoR, therefore it is likely that construction disturbance to Hochstetter's frog populations could result in changes in the population dynamics.	Indirect	Local	Short-term (<5 years)	Frequently	Highly Likely	Totally	Low	Low
Operation	Presence of the road	R5 - Hochstetter's frog	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Upgrade of existing Sandspit Road. WW5-S1 will be directly impacted by the NoR, with increased fragmentation from the current culvert, therefore loss in connectivity that could result in changes in the population dynamics is considered likely.	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Low
Operation	Presence of the road	R5 - Hochstetter's frog	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Baseline. Upgrade of existing Sandspit Road. As the NoR is an upgrade of an existing road, it is expected that Hochstetter's frog would be habituated to road disturbance.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R5 - Hochstetter's frog	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. Stream habitat will remain in the FEE and therefore similar likelihood as baseline NoR is located in Future Urban Zone. Native vegetation on the east of Sandspit Road (on the eastern side of the Mahurangi River tributary) is expected to be retained, however there is an area of Future Urban Zone between this vegetation throughout most of the NoR. It is expected that any populations present would be habituated to disturbance in this environment, therefore it is not anticipated that disturbance to Hochstetter's frogs will result in changes to the population dynamics. Therefore, the magnitude and level of effect are considered lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Highly Likely	Totally	Low	Low
Operation	Presence of the road	R5 - Hochstetter's frog	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Native vegetation on the east of Sandspit Road (on the eastern side of the Mahurangi River tributary) is expected to be retained, however there is an area of Future Urban Zone between this vegetation throughout most of the NoR. It is anticipated that there would be existing fragmentation in this environment. Therefore, the magnitude and level of effect are considered lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R5 - Hochstetter's frog	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Native vegetation on the east of Sandspit Road (on the eastern side of the Mahurangi River tributary) is expected to be retained, however there is an area of Future Urban Zone between this vegetation throughout most of the NoR.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low

NoR R6														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Construction	Noise/lighting/vibration/ dust	R6-Bat	Very High	Construction- Bats	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.)	Baseline. NoR area unlikely to be utilised by bats. Therefore bats are unlikely to be disturbed by construction activities.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Low
Operation	Presence of the road	R6-Bat	Very High	Operation- Bats	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	Baseline. NoR area unlikely to be utilised by bats. Negligible loss in connectivity is anticipated. Note: Extent (ZOI) changed to 'Local' as no additional fragmentation expected, to decrease Level of Effect from 'Moderate' to 'Low'.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low
Operation	Presence of the road	R6-Bat	Very High	Operation- Bats	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration	Baseline. NoR area unlikely to be utilised by bats. Therefore bats are unlikely to be disturbed by the presence of the road.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low
Construction	Noise/lighting/vibration/ dust	R6-Bat	Very High	Construction- Bats	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.)	Likely Future Ecological Environment. NoR is located in Future Urban Zone and Business Zones and NoR area unlikely to be utilised by bats. Therefore, bats are unlikely to be disturbed by construction activities in this environment.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Low
Operation	Presence of the road	R6-Bat	Very High	Operation- Bats	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	Likely Future Ecological Environment. NoR is located in Future Urban Zone and Business Zones. No loss in connectivity anticipated in this environment. Note: Extent (ZOI) changed to 'Local' as no additional fragmentation expected, to decrease Level of Effect from 'Moderate' to 'Low'.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low
Operation	Presence of the road	R5-Bat		Operation- Bats	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration	Likely Future Ecological Environment. NoR is located in Future Urban Zone and Business Zones and NoR area unlikely to be utilised by bats, therefore bats are unlikely to be disturbed by the presence of the road.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	
Construction	Noise/lighting/vibration/ dust	R6 - Non-TAR bird	Low	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. New road through an area that is predominantly grazed pasture, adjacent to an industrial/business area. The area is already fragmented by farming activities (mainly grazed pasture), however non-TAR native birds may be foraging and nesting in the area of WL19 (WW6-W1). There is limited availiablity of this habitat in the wider landscape. Therefore disturbance resulting in changes to the population dynamics is considered highly likely.	Indirect	Local	Short-term (<5 years)	Frequently	Highly Likely	Totally	Low	Very Low
Operation	Presence of the road	R6 - Non-TAR bird	Low	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. New road through an area that is predominantly grazed pasture, adjacent to an industrial/business area. The area is already fragmented by farming activities (mainly grazed pasture), however non-TAR native birds may be reliant on the area of WL19 (WW6-W1). This is proposed to be bridged, however connectivity is anticipated to remain. Therefore a loss in connectivity is not considered to result in changes to the population dynamics.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R6 - Non-TAR bird	Low	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. New road through an area that is predominantly grazed pasture, adjacent to an industrial/business area. The area is already fragmented by farming activities (mainly grazed pasture), however non-TAR native birds may be foraging and nesting in the area of WL19 (WW6-W1). There is limited availiablity of this habitat in the wider landscape. Therefore disturbance resulting in changes to the population dynamics is considered highly likely.	Indirect	Local	Permanent (>25 years)	Continuously	Highly Likely	Irreversible	Moderate	Low

NoR R6														
Phase	**Project Activity**	**Resource Unit (Habitat/Species)**	**Ecological Value**	**Effect Description Main**	**Effect Description Detailed**	**Effects Description Manual**	**Type**	**Extent (ZOI)**	**Duration**	**Frequency**	**Likelihood**	**Reversibility**	**Magnitude (pre-mitigation)**	**Level of Effect (Pre-mitigation)**
Construction	Noise/lighting/vibration/ dust	R5 - Non-TAR bird		Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone and Business Zones. It is anticipated that birds present will be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	
Operation	Presence of the road	R6 - Non-TAR bird	Low	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone and Business Zones. It is anticipated that the habitat will already be fragmented in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R6 - Non-TAR bird	Low	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone and Business Zones. It is anticipated that birds present will be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)	Continuously	Unlikely	Irreversible	Low	Very Low
Construction	Noise/lighting/vibration/ dust	R6 - New Zealand pipit	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. New Zealand pipit have the potential to utilise any open habitat such as Exotic Grassland and Exotic Scrub (both present in NoR R6). New road through an area that is predominantly grazed pasture, adjacent to an industrial/business area. Note: 'Definite' likelihood assigned, as New Zealand pipit will require specific management during construction to prevent disturbance to nesting birds in the area.	Indirect	Local	Short-term (<5 years)	Frequently	Definite	Totally	Moderate	High
Operation	Presence of the road	R6 - New Zealand pipit	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. New Zealand pipit have the potential to utilise any open habitat such as Exotic Grassland and Exotic Scrub (both present in NoR R6). New road through an area that is predominantly grazed pasture, adjacent to an industrial/business area. Due to the large area of pasture that is avaliable, which is suitable habitat for pipit, higher densities of pipit are expected in this NoR. Although the NoR is a new road, the area on the northern side of the NoR is low quality habitat for pipit (due to existing disturbance and earthworks unrelated to the Project), therefore a loss in connectivity is unlikely.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R6 - New Zealand pipit	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. New Zealand pipit have the potential to utilise any open habitat such as Exotic Grassland and Exotic Scrub (both present in NoR R6). New road through an area that is predominantly grazed pasture, adjacent to an industrial/business area. Due to the large area of pasture that is avaliable, which is suitable habitat for pipit, higher densities of pipit are expected in this NoR. As the NoR is a new road, it is likely that pipit would be disturbed by the presence of the road.	Indirect	Local	Permanent (>25 years)	Infrequently	Likely	Irreversible	Low	Low
Construction	Noise/lighting/vibration/ dust	R6 - New Zealand pipit	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone and Business Zones. Suitable habitat for New Zealand pipit (EG, ES) is not anticipated to be present in this environment. Therefore, the magnitude and level of effect are considered lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low

NoR R6														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Operation	Presence of the road	R6 - New Zealand pipit	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone and Business Zones. Suitable habitat for New Zealand pipit (EG, ES) is not anticipated to be present in this environment. Therefore, the magnitude and level of effect are considered lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R6 - New Zealand pipit	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone and Business Zones. Suitable habitat for New Zealand pipit (EG, ES) is not anticipated to be present in this environment. Therefore, the magnitude and level of effect are considered lower than Baseline.	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R6 - Spotless crake	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Spotless crake potentially foraging and nesting in an area of WL19 (WW6-W1) and associated intermittent stream, this is proposed to be bridged. Also potential to be foraging and nesting in an exotic wetland at the eastern side of the NoR (WW3-W1). Spotless crake are known to be in the wider area as they have been picked up in nearby acoustic surveys, and have the potential to be nesting in wetlands present in the NoR (M. Baber, personal communication, 27 January 2023). Note: A manual 'Moderate' level of effect has been assigned, as spotless crake will require specific management during construction to prevent disturbance to nesting birds in the area.	Indirect	Local	Short-term (<5 years)	Frequently	Highly Likely	Totally	Low	Moderate
Operation	Presence of the road	R6 - Spotless crake	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Spotless crake potentially foraging and nesting in an area of WL19 (WW6-W1) and associated intermittent stream, this is proposed to be bridged. Also potential to be foraging and nesting in an exotic wetland at the eastern side of the NoR (WW3-W1). Although the proposed bridge intersects the area of WL19, the wetland is located in a fragmented landscape, therefore it is not anticipated that the bridge would cause a loss in connectivity that would result in changes to the population dynamics.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R6 - Spotless crake	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Spotless crake potentially foraging and nesting in an area of WL19 (WW6-W1) and associated intermittent stream, this is proposed to be bridged. Also potential to be foraging and nesting in an exotic wetland at the eastern side of the NoR (WW3-W1). Spotless crake are known to be in the wider area as they have been picked up in nearby acoustic surveys, and have the potential to be nesting in wetlands present in the NoR (M. Baber, personal communication, 27 January 2023). Note: A manual 'Moderate' level of effect has been assigned, as spotless crake will require specific management to prevent disturbance to nesting birds in the area from the presence of the road.	Indirect	Local	Permanent (>25 years)	Frequently	Likely	Irreversible	Low	Moderate
Construction	Noise/lighting/vibration/ dust	R6 - Spotless crake	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone and Business Zones. Delineated wetlands will be retained (and habitat quality likely improved) in the Likely Future Ecological Environment. Therefore there is higher potential for spotless crake to be foraging and nesting in this habitat, and could be disturbed by construction activities. Note: A manual 'Moderate' level of effect has been assigned, as spotless crake will require specific management during construction to prevent disturbance to nesting birds in the area.	Indirect	Local	Short-term (<5 years)	Frequently	Highly Likely	Totally	Low	Moderate

NoR R6														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Operation	Presence of the road	R6 - Spotless crake	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone and Business Zones. Although the proposed bridge intersects the area of WL19, the wetland is located in a fragmented landscape, therefore it is not anticipated that the bridge would cause a loss in connectivity that would result in changes to the population dynamics.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R6 - Spotless crake	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone and Business Zones. Delineated wetlands will be retained (and habitat quality likely improved) in the Likely Future Ecological Environment. Therefore there is higher potential for spotless crake to be foraging and nesting in this habitat, and could be disturbed by the presence of the road. Note: A manual 'Moderate' level of effect has been assigned, as spotless crake will require specific management to prevent disturbance to nesting birds in the area from the presence of the road.	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Moderate
Construction	Noise/lighting/vibration/ dust	R6 - Australasian bittern	Very High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Australasian bittern potentially foraging in an area of WL19 (WW6-W1) and associated intermittent stream, this is proposed to be bridged. Also potential to be foraging in an exotic wetland at the eastern side of the NoR (WW3-W1). Australasian bittern are considered a highly mobile species in this area, with high dispersal. Therefore, it is unlikely that construction disturbance will result in changes to the population dynamics.	Indirect	Local	Short-term (<5 years)	Infrequently	Unlikely	Totally	Negligible	Low
Operation	Presence of the road	R6 - Australasian bittern	Very High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Australasian bittern potentially foraging in an area of WL19 (WW6-W1) and associated intermittent stream, this is proposed to be bridged. Also potential to be foraging in an exotic wetland at the eastern side of the NoR (WW3-W1). As Australasian bittern are considered a highly mobile species in this area, with high dispersal, a loss in connectivity that results in changes to the population dynamics is considered unlikely.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low
Operation	Presence of the road	R6 - Australasian bittern	Very High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Australasian bittern potentially foraging in an area of WL19 (WW6-W1) and associated intermittent stream, this is proposed to be bridged. Also potential to be foraging in an exotic wetland at the eastern side of the NoR (WW3-W1). Australasian bittern are considered a highly mobile species in this area, with high dispersal. Therefore, it is unlikely that disturbance from the presence of the road will result in changes to the population dynamics.	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Low
Construction	Noise/lighting/vibration/ dust	R6 - Australasian bittern	Very High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone and Business Zones. Australasian bittern are considered a mobile species in this area, with high dispersal, and unlikely to be nesting. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Infrequently	Unlikely	Totally	Negligible	Low
Operation	Presence of the road	R6 - Australasian bittern	Very High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone and Business Zones. Australasian bittern are considered a mobile species in this area, with high dispersal, and unlikely to be nesting. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low

NoR R6														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Operation	Presence of the road	R6 - Australasian bittern	Very High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone and Business Zones. Australasian bittern are considered a mobile species in this area, with high dispersal, and unlikely to be nesting. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Low
Construction	Noise/lighting/vibration/ dust	R6 - Copper skink	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Copper skink habitat in NoR R6 is located near areas of existing disturbance (e.g. areas of PL.1 and ES adjacent to Jamie Lane). Therefore it is considered unlikely that copper skink would be disturbed by construction activities.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R6 - Copper skink	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Copper skink habitat is considered low quality in NoR R6, and habitat present is located in an already fragmented environment. Therefore loss in connectivity that results in changes to the population dynamics is considered unlikely.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R6 - Copper skink	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Baseline. Copper skink habitat in NoR R6 is located near areas of existing disturbance (e.g. areas of PL.1 and ES adjacent to Jamie Lane). Therefore it is considered unlikely that copper skink would be disturbed by the presence of the road.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R6 - Copper skink	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone and Business Zones. Suitable habitat for copper skink is not anticipated to be present (or very limited/low quality) in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R6 - Copper skink	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone and Business Zones. Suitable habitat for copper skink is not anticipated to be present (or very limited/low quality) in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R6 - Copper skink	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone and Business Zones. Suitable habitat for copper skink is not anticipated to be present (or very limited/low quality) in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low

NoR R7														
Phase	**Project Activity**	**Resource Unit (Habitat/Species)**	**Ecological Value**	**Effect Description Main**	**Effect Description Detailed**	**Effects Description Manual**	**Type**	**Extent (ZOI)**	**Duration**	**Frequency**	**Likelihood**	**Reversibility**	**Magnitude (pre-mitigation)**	**Level of Effect (Pre-mitigation)**
Construction	Noise/lighting/vibration/ dust	R7-Bat	Very High	Construction- Bats	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.)	Baseline. Multiple new stream crossings and stream loss of corridors that are likely to be utilised by bats for commuting and foraging. Roosts also likely present in associated native vegetation near streams. Bats are highly likely to be disturbed by construction activities.	Indirect	Local	Short-term (<5 years)	Frequently	Highly Likely	Totally	Low	Moderate
Operation	Presence of the road	R7-Bat	Very High	Operation- Bats	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	Baseline. Multiple new stream crossings and stream loss of corridors that are likely to be utilised by bats. Note: no significant ecological node upslope of where the NoR crosses the streams. Only a small portion of WF11 will be fragmented. Extent adjusted to 'Local' due to the lack of significant bat habitat uplsope of where NoR crosses streams Mitigation: light sensitive design and road crossings, retain existing mature trees as far as practicable and late stage buffer planting between road deck and designation boundary at all stream crossings	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Moderate
Operation	Presence of the road	R7-Bat	Very High	Operation- Bats	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration	Baseline. Multiple new stream crossings and stream loss of corridors likely to be utilised by bats for commuting and foraging. Roosts also likely present in associated native vegetation near streams. Bats are highly likely to be disturbed by the presence of the road.	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Moderate
Construction	Noise/lighting/vibration/ dust	R7-Bat	Very High	Construction- Bats	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.)	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone, however it is anticpated that the permanent streams and terrestrial vegetation east of the streams will remain, therefore the bat corridor will be retained. As the surrounding area is Future Urban Zone, it is likely that bats would be disturbed by construction activities (as opposed to highly likely).	Indirect	Local	Short-term (<5 years)	Frequently	Likely	Totally	Low	Moderate
Operation	Presence of the road	R7-Bat	Very High	Operation- Bats	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone, however it is anticpated that the permanent streams and terrestrial vegetation east of the streams will remain, therefore the bat corridor will be retained. Although the stream crossings/stream loss will be less than Baseline, the permanent streams will remain intact, therefore loss in connectivity is still anticipated to occur due to new stream crossings/stream loss. Extent adjusted to 'Local' due to the lack of significant bat habitat uplsope of where NoR crosses streams	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Moderate
Operation	Presence of the road	R7-Bat	Very High	Operation- Bats	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone, however it is anticpated that the permanent streams and terrestrial vegetation east of the streams will remain, therefore the bat corridor will be retained. As the surrounding area is Future Urban Zone, it is likely that bats would be disturbed by the presence of the road (as opposed to highly likely).	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Moderate
Construction	Noise/lighting/vibration/ dust	R7 - Non-TAR bird	Low	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. As the NoR is a new road that will be intersecting high quality habitat for non-TAR species, it is highly likely that disturbance will occur that will result in changes to the population dynamics.	Indirect	Local	Short-term (<5 years)	Frequently	Highly Likely	Totally	Low	Very Low
Operation	Presence of the road	R7 - Non-TAR bird	Low	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. As the NoR is a new road that will be intersecting high quality habitat for non-TAR species, it is highly likely that loss in connectivity resulting in changes to the population dynamics with occur (particularly for species will a small home range, such as grey warbler).	Indirect	Local	Permanent (>25 years)		Highly Likely	Irreversible	Moderate	Low
Operation	Presence of the road	R7 - Non-TAR bird	Low	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. As the NoR is a new road that will be intersecting high quality habitat for non-TAR species, it is highly likely that disturbance will occur that will result in changes to the population dynamics.	Indirect	Local	Permanent (>25 years)	Frequently	Highly Likely	Irreversible	Moderate	Low

NoR R7														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Construction	Noise/lighting/vibration/ dust	R7 - Non-TAR bird	Low	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. It is anticipated that birds present will be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R7 - Non-TAR bird	Low	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. It is anticipated that the habitat will already be fragmented in this environment. Therefore, the magnitude and level of effect are considered lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R7 - Non-TAR bird	Low	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. It is anticipated that birds present will be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered lower than Baseline.	Indirect	Local	Permanent (>25 years)	Frequently	Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R7 - New Zealand pipit	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. New Zealand pipit have the potential to utilise any open habitat such as Exotic Grassland and Exotic Scrub (EG is present in NoR R7). Note: 'Definite' likelihood assigned, as New Zealand pipit will require specific management during construction to prevent disturbance to nesting birds in the area.	Indirect	Local	Short-term (<5 years)	Frequently	Definite	Totally	Moderate	High
Operation	Presence of the road	R7 - New Zealand pipit	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. New Zealand pipit have the potential to utilise any open habitat such as Exotic Grassland and Exotic Scrub (EG is present in NoR R7). Although a new road will be intersecting pipit habitat and high densities of pipit are expected in the NoR, the current wider landscape has a large extent of pipit habitat available, both south and north of the NoR. Therefore, it's unlikely that this loss in connectivity would result in changes to the population dynamics.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R7 - New Zealand pipit	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. New Zealand pipit have the potential to utilise any open habitat such as Exotic Grassland and Exotic Scrub (EG is present in NoR R7). Although a new road will be intersecting pipit habitat and high densities of pipit are expected in the NoR, the current wider landscape has a large extent of pipit habitat available. Therefore, it's unlikely that disturbance to pipit from construction activities would result in changes to the population dynamics.	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R7 - New Zealand pipit	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. Suitable habitat for New Zealand pipit is not anticipated to be present in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low

NoR R7														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Operation	Presence of the road	R7 - New Zealand pipit	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. Suitable habitat for New Zealand pipit is not anticipated to be present in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R7 - New Zealand pipit	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. Suitable habitat for New Zealand pipit is not anticipated to be present in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R7 - North Island kākā	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Kākā are considered a highly mobile species in this area, with seasonal use and high dispersal. Therefore they are unlikely to be disturbed by construction activities.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R7 - North Island kākā	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Although the new road will be intersecting potential kākā habitat (WF11, MF4), there is only a small extent of habitat avaliable (with the exception of EF) leftover on the northern/eastern side of the NoR. As the majority of the suitable kākā habitat (WF11, MF4) will remain intact south/west of the NoR, it is unlikely that this loss in connectivity would result in changes to the population dynamics.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R7 - North Island kākā	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Kākā are considered a highly mobile species in this area, with seasonal use and high dispersal. Therefore they are unlikely to be disturbed by the presence of the road.	Indirect	Local	Permanent (>25 years)	Frequently	Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R7 - North Island kākā	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. It is anticipated that birds present will be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Infrequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R7 - North Island kākā	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. It is anticipated that kākā habitat would already be fragmented in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R7 - North Island kākā	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. It is anticipated that birds present will be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Very Low

NoR R7														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Construction	Noise/lighting/vibration/ dust	R7 - Long-tailed cuckoo	Very High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Long-tailed cuckoo are considered a highly mobile species in this area, with high dispersal. Therefore they are unlikely to be disturbed by construction activities.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Low
Operation	Presence of the road	R7 - Long-tailed cuckoo	Very High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Although the new road will be intersecting potential long-tailed cuckoo habitat (WF11, MF4), there is only a small extent of habitat avaliable (with the exception of EF) leftover on the northern/eastern side of the NoR. As the majority of the suitable long-tailed cuckoo habitat (WF11, MF4) will remain intact south/west of the NoR, it is unlikely that this loss in connectivity would result in changes to the population dynamics.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low
Operation	Presence of the road	R7 - Long-tailed cuckoo	Very High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Long-tailed cuckoo are considered a highly mobile species in this area, with high dispersal. In addition, the majority of suitable habitat (WF11, MF4) south/west of the NoR remains intact. Therefore they are unlikely to be disturbed by the presence of the road.	Indirect	Local	Permanent (>25 years)	Frequently	Unlikely	Irreversible	Negligible	Low
Construction	Noise/lighting/vibration/ dust	R7 - Long-tailed cuckoo	Very High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. It is anticipated that birds present will be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Infrequently	Unlikely	Totally	Negligible	Low
Operation	Presence of the road	R7 - Long-tailed cuckoo	Very High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. It is anticipated that long-tailed cuckoo habitat would already be fragmented in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low
Operation	Presence of the road	R7 - Long-tailed cuckoo	Very High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. It is anticipated that birds present will be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Low
Construction	Noise/lighting/vibration/ dust	R7 - Black shag	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Likely utilising permanent open water in the NoR (WW7-S2a, WW7-S3a, WW7-S4, WW5-S2). Black shag are likely foraging but not nesting in this habitat (as they breed colonially), in addition they are considered a mobile species. Therefore it is unlikely that disturbance from construction activities would result in changes to the population dynamics.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low

NoR R7														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Operation	Presence of the road	R7 - Black shag	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Likely utilising permanent open water in the NoR (WW7-S2a, WW7-S3a, WW7-S4, WW5-S2). WW7-S2a, WW7-S4, and WW7-S6a will be bridged, and minimal habitat is available north of the NoR at WW7-S3a. Therefore, it is unlikely that this loss in connectivity will result in changes to the population dynamics.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R7 - Black shag	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Likely utilising permanent open water in the NoR (WW7-S2a, WW7-S3a, WW7-S4, WW5-S2). Black shag are likely foraging but not nesting in this habitat (as they breed colonially), in addition they are considered a mobile species. Therefore it is unlikely that disturbance from the presence of the road would result in changes to the population dynamics.	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R7 - Black shag	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. Although the open water habitat is expected to remain, it is anticipated that birds present will be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R7 - Black shag	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. WW7-S2a, WW7-S4, and WW7-S6a will be bridged, and minimal habitat will be available north of the NoR at WW7-S3a. Therefore, it is unlikely that this loss in connectivity will result in changes to the population dynamics.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R7 - Black shag	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. Although the open water habitat is expected to remain, it is anticipated that birds present will be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)	Frequently	Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R7 - Little black shag, pied shag, little shag	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Likely utilising permanent open water in the NoR (WW7-S2a, WW7-S3a, WW7-S4, WW5-S2). Shags are likely foraging but not nesting in this habitat (as they breed colonially), in addition they are considered a mobile species. Therefore it is unlikely that disturbance from construction activities would result in changes to the population dynamics.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low

NoR R7														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Operation	Presence of the road	R7 - Little black shag, pied shag, little shag	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Likely utilising permanent open water in the NoR (WW7-S2a, WW7-S3a, WW7-S4, WW5-S2). WW7-S2a, WW7-S4, and WW7-S6a will be bridged, and minimal habitat is available north of the NoR at WW7-S3a. Therefore, it is unlikely that this loss in connectivity will result in changes to the population dynamics.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R7 - Little black shag, pied shag, little shag	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Likely utilising permanent open water in the NoR (WW7-S2a, WW7-S3a, WW7-S4, WW5-S2). Shags are likely foraging but not nesting in this habitat (as they breed colonially), in addition they are considered a mobile species. Therefore it is unlikely that disturbance from the presence of the road would result in changes to the population dynamics.	Indirect	Local	Permanent (>25 years)	Frequently	Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R7 - Little black shag, pied shag, little shag	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. Although the open water habitat is expected to remain, it is anticipated that birds present will be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R7 - Little black shag, pied shag, little shag	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. WW7-S2a, WW7-S4, and WW7-S6a will be bridged, and minimal habitat will be available north of the NoR at WW7-S3a. Therefore, it is unlikely that this loss in connectivity will result in changes to the population dynamics.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R7 - Little black shag, pied shag, little shag	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. Although the open water habitat is expected to remain, it is anticipated that birds present will be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)	Frequently	Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R7 - Spotless crake	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Lkely utilising large wetlands (> 5000 m2) that are present in the NoR (WW7-W3) for foraging and nesting. As construction activities will take place within this wetland, it is highly likely that birds will be disturbed. Spotless crake are known to be in the wider area as they have been picked up in nearby acoustic surveys, and have the potential to be nesting in wetlands present in the NoR (M. Baber, personal communication, 27 January 2023). Note: A manual 'Moderate' level of effect has been assigned, as spotless crake will require specific management during construction to prevent disturbance to nesting birds in the area.	Indirect	Local	Short-term (<5 years)	Frequently	Highly Likely	Totally	Low	Moderate

NoR R7														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Operation	Presence of the road	R7 - Spotless crake	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Lkely utilising large wetlands (> 5000 m2) that are present in the NoR (WW7-W3). As the NoR is a new road that is located within this wetland, it is likely that loss in connectivity will occur. However, as spotless crake are considered to have 'good dispersal ability' (Cotter, 2016), and due to the extent of WW7-W3 that will remain north and south of the NoR, it is unlikely that this loss in connectivity will result in changes to the population dynamics.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R7 - Spotless crake	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Lkely utilising large wetlands (> 5000 m2) that are present in the NoR (WW7-W3) for foraging and nesting. As the NoR is a new road that is located within this wetland, it is likely that birds will be disturbed. Spotless crake are known to be in the wider area as they have been picked up in nearby acoustic surveys, and have the potential to be nesting in wetlands present in the NoR (M. Baber, personal communication, 27 January 2023). Note: A manual 'Moderate' level of effect has been assigned, as spotless crake will require specific management to prevent disturbance to nesting birds in the area from the presence of the road.	Indirect	Local	Permanent (>25 years)	Frequently	Likely	Irreversible	Low	Moderate
Construction	Noise/lighting/vibration/ dust	R7 - Spotless crake	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. Delineated wetlands will be retained (and habitat quality likely improved) in the Likely Future Ecological Environment. Therefore there is higher potential for spotless crake to be foraging and nesting in this habitat, and could be disturbed by construction activities. Note: A manual 'High' level of effect has been assigned, as spotless crake will require specific management during construction to prevent disturbance to nesting birds in the area.	Indirect	Local	Short-term (<5 years)	Frequently	Highly Likely	Totally	Low	Moderate
Operation	Presence of the road	R7 - Spotless crake	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. Although it is anticipated that the delineated wetland will be retained, spotless crake are considered to have 'good dispersal ability' (Cotter, 2016), and there is good extent of wetland habitat that will remain. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R7 - Spotless crake	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. Delineated wetlands will be retained (and habitat quality likely improved) in the Likely Future Ecological Environment. Therefore there is higher potential for spotless crake to be foraging and nesting in this habitat, and could be disturbed by the presence of the road. Note: A manual 'High' level of effect has been assigned, as spotless crake will require specific management to prevent disturbance to nesting birds in the area from the presence of the road.	Indirect	Local	Permanent (>25 years)	Frequently	Likely	Irreversible	Low	Moderate

NoR R7														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Construction	Noise/lighting/vibration/ dust	R7 - Australasian bittern	Very High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Lkely utilising large wetlands (> 5000 m2) that are present in the NoR (WW7-W3) for foraging and nesting. As construction activities will take place within this wetland, it is highly likely that birds will be disturbed. However, as Australasian bittern are considered a highly mobile species in this area, with high dispersal, and due to the extent of WW7-W3 that will remain north and south of the NoR, it is unlikely that this disturbance will result in changes to the population dynamics.	Indirect	Local	Short-term (<5 years)	Infrequently	Unlikely	Totally	Negligible	Low
Operation	Presence of the road	R7 - Australasian bittern	Very High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Lkely utilising large wetlands (> 5000 m2) that are present in the NoR (WW7-W3). As the NoR is a new road that is located within this wetland, it is highly likely that loss in connectivity will occur. However, as spotless crake are considered a highly mobile species in this area, with high dispersal, and due to the extent of WW7-W3 that will remain north and south of the NoR, it is unlikely that this loss in connectivity will result in changes to the population dynamics.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low
Operation	Presence of the road	R7 - Australasian bittern	Very High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Lkely utilising large wetlands (> 5000 m2) that are present in the NoR (WW7-W3) for foraging and nesting. As the NoR is a new road that is located within this wetland, it is highly likely that birds will be disturbed. However, as Australasian bittern are considered a highly mobile species in this area, with high dispersal, and due to the extent of WW7-W3 that will remain north and south of the NoR, it is unlikely that this disturbance will result in changes to the population dynamics.	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Low
Construction	Noise/lighting/vibration/ dust	R7 - Australasian bittern	Very High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. Australasian bittern are considered a mobile species in this area, with high dispersal, and unlikely to be nesting. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Infrequently	Unlikely	Totally	Negligible	Low
Operation	Presence of the road	R7 - Australasian bittern	Very High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. Although it is anticipated that the delineated wetland will be retained, as Australasian bittern are considered a highly mobile species in this area, with high dispersal, a loss in connectivity that results in changes to the population dynamics is considered unlikely. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low
Operation	Presence of the road	R7 - Australasian bittern	Very High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. Australasian bittern are considered a mobile species in this area, with high dispersal, and unlikely to be nesting. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Low

NoR R7														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Construction	Noise/lighting/vibration/ dust	R7 - Copper skink	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. As the NoR is a new road that intersects potential copper skink habitat, and due to their small home range, it is likely that copper skink will be disturbed by construction activities.	Indirect	Local	Short-term (<5 years)	Frequently	Likely	Totally	Low	Low
Operation	Presence of the road	R7 - Ornate skink	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. As the NoR is a new road that intersects potential copper skink habitat, and due to their small home range, it is likely that loss in connectivity will occur.	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Low
Operation	Presence of the road	R7 - Copper skink	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Baseline. As the NoR is a new road that intersects potential copper skink habitat, and due to their small range, it is likely that copper skink will be disturbed by the presence of the road.	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Low
Construction	Noise/lighting/vibration/ dust	R7 - Copper skink	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. Suitable habitat for copper skink is not anticipated to be present (or very limited/low quality) in this environment. Therefore, the magnitude and level of effect are considered lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R7 - Copper skink	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. Suitable habitat for copper skink is not anticipated to be present (or very limited/low quality) in this environment. Therefore, the magnitude and level of effect are considered lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R7 - Copper skink	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. Suitable habitat for copper skink is not anticipated to be present (or very limited/low quality) in this environment. Therefore, the magnitude and level of effect are considered lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R7 - Ornate skink	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. As the NoR is a new road that intersects potential ornate skink habitat, and due to their small home range, it is likely that ornate skink will be disturbed by construction activities.	Indirect	Local	Short-term (<5 years)	Frequently	Likely	Totally	Low	Low
Operation	Presence of the road	R7 - Ornate skink	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. As the NoR is a new road that intersects potential ornate skink habitat, and due to their small home range, it is likely that loss in connectivity will occur.	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Low
Operation	Presence of the road	R7 - Ornate skink	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Baseline. As the NoR is a new road that intersects potential ornate skink habitat, and due to their small range, it is likely that ornate skink will be disturbed by the presence of the road.	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Low
Construction	Noise/lighting/vibration/ dust	R7 - Ornate skink	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. Suitable habitat for ornate skink is not anticipated to be present (or very limited/low quality) in this environment. Therefore, the magnitude and level of effect are considered lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R7 - Ornate skink	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. Suitable habitat for ornate skink is not anticipated to be present (or very limited/low quality) in this environment. Therefore, the magnitude and level of effect are considered lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low

NoR R7														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Operation	Presence of the road	R7 - Ornate skink	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. Suitable habitat for ornate skink is not anticipated to be present (or very limited/low quality) in this environment. Therefore, the magnitude and level of effect are considered lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R7 - Elegant gecko and forest gecko	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Arboreal gecko species are potentially utilising the large stands of native terrestrial vegetation (WF11, MF4) that are present within the NoR. As they are nocturnal species, and as the NoR is a new road, it is highly likely that they are highly sensitive to construction disturbance, particularly construction lighting at night.	Indirect	Local	Short-term (<5 years)	Frequently	Highly Likely	Totally	Low	Low
Operation	Presence of the road	R7 - Elegant gecko and forest gecko	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Although data is limited on the home range of geckos, due to the extent of habitat loss (approximately 4150 m2 of WF111), and to conservatively asses this effect, it is likely that this loss in connectivity will result in changes to the population dynamics.	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Low
Operation	Presence of the road	R7 - Elegant gecko and forest gecko	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Baseline. Arboreal gecko species are potentially utilising the large stands of native terrestrial vegetation (WF11, MF4) that are present within the NoR. As they are nocturnal species, and as the NoR is a new road, it is likely that they are highly sensitive to disturbance from the presence of the road (particularly lighting at night).	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Low
Construction	Noise/lighting/vibration/ dust	R7 - Elegant gecko and forest gecko	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. Although it is anticipated that suitable gecko habitat will be retained in the buffer of streams, it is expected that gecko will already be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R7 - Elegant gecko and forest gecko	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. It is anticipated that suitable gecko habitat will be retained in the buffer of streams, and the NoR will impact the areas of WF11 associated with WW7-S2b and WW7-S3a. To conservatively asses this effect, it is likely that this loss in connectivity will result in changes to the population dynamics.	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Low
Operation	Presence of the road	R7 - Elegant gecko and forest gecko	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. Although it is anticipated that suitable gecko habitat will be retained in the buffer of streams, it is expected that gecko will already be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R7 - Pacific gecko	Moderate	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Arboreal gecko species are potentially utilising the large stands of native terrestrial vegetation (WF11, MF4) that are present within the NoR. As they are nocturnal species, and as the NoR is a new road, it is likely that they are highly sensitive to construction disturbance, particularly construction lighting at night.	Indirect	Local	Short-term (<5 years)	Frequently	Highly Likely	Totally	Low	Low

NoR R7														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Operation	Presence of the road	R7 - Pacific gecko	Moderate	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Although data is limited on the home range of geckos, due to the extent of habitat loss (approximately 4150 m2 of WF111), and to conservatively asses this effect, it is likely that this loss in connectivity will result in changes to the population dynamics.	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Low
Operation	Presence of the road	R7 - Pacific gecko	Moderate	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Baseline. Arboreal gecko species are potentially utilising the large stands of native terrestrial vegetation (WF11, MF4) that are present within the NoR. As they are nocturnal species, and as the NoR is a new road, it is highly likely that they are highly sensitive to disturbance from the presence of the road (particularly lighting at night).	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Low
Construction	Noise/lighting/vibration/ dust	R7 - Pacific gecko	Moderate	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. Although it is anticipated that suitable gecko habitat will be retained in the buffer of streams, it is expected that gecko will already be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R7 - Pacific gecko	Moderate	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. It is anticipated that suitable gecko habitat will be retained in the buffer of streams, and the NoR will impact the areas of WF11 associated with WW7-S2b and WW7-S3a. To conservatively asses this effect, it is likely that this loss in connectivity will result in changes to the population dynamics.	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Low
Operation	Presence of the road	R7 - Pacific gecko	Moderate	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. Although it is anticipated that suitable gecko habitat will be retained in the buffer of streams, it is expected that gecko will already be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R7 - Hochstetter's frog	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Hochstetter's frog populations may be present in the permanent stream WW7-S4. Due to their nocturnal nature, it is expected that Hochstetter's frog will be highly sensitive to construction activities, particularly lighting at night. WW7-S4 will be bridged, therefore construction activities will take place within close proximity of potential habitat. Therefore it is likely that construction activities could cause disturbance to Hochstetter's frog populations. It is not assessed as highly likely as the disturbance is localised relative to the population.	Indirect	Local	Short-term (<5 years)	Frequently	Likely	Totally	Low	Low
Operation	Presence of the road	R7 - Hochstetter's frog	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. As WW7-S4 will be bridged, it is anticipated that connectivity will be remain intact. There will be some loss in connectivity related to increased lighting disturbance, therefore loss in connectivity that could result in changes in the population dynamics is considered likely.	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Low

NoR R7														
Phase	**Project Activity**	**Resource Unit (Habitat/Species)**	**Ecological Value**	**Effect Description Main**	**Effect Description Detailed**	**Effects Description Manual**	**Type**	**Extent (ZOI)**	**Duration**	**Frequency**	**Likelihood**	**Reversibility**	**Magnitude (pre-mitigation)**	**Level of Effect (Pre-mitigation)**
Operation	Presence of the road	R7 - Hochstetter's frog	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Baseline. As they are nocturnal species, and as the NoR is a new road, it is likely that they are highly sensitive to disturbance from the presence of the road (particularly lighting at night). Therefore it is likely that the presence of the road could cause disturbance to Hochstetter's frog populations. It is not assessed as highly likely as the disturbance is localised relative to the population.	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Low
Construction	Noise/lighting/vibration/ dust	R7 - Hochstetter's frog	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. It is expected that any populations present would be habituated to disturbance in this environment, therefore it is not anticipated that disturbance to Hochstetter's frogs will result in changes to the population dynamics. Therefore, the magnitude and level of effect are considered lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R7 - Hochstetter's frog	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. As Hochstetter's frog habitat is expected to remain in the Future Urban Zone (stream and riparian margin), the magnitude and level effect are considered the same as Baseline.	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Low
Operation	Presence of the road	R7 - Hochstetter's frog	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special Purpose - Quarry Zone. It is expected that any populations present would be habituated to disturbance in this environment, therefore it is not anticipated that disturbance to Hochstetter's frogs will result in changes to the population dynamics. Therefore, the magnitude and level of effect are considered lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low

NoR R8														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Construction	Noise/lighting/vibration/ dust	R8-Bat	Very High	Construction- Bats	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.)	Baseline. Multiple new stream crossings and stream loss of corridors that are likely to be utilised by bats for commuting and foraging. Bats are highly likely to be disturbed by construction activities.	Indirect	Local	Short-term (<5 years)	Frequently	Likely	Totally	Low	Moderate
Operation	Presence of the road	R8-Bat	Very High	Operation- Bats	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	Baseline. Multiple new stream crossings and stream loss of corridors that are likely to be utilised by bats.	Indirect	Regional	Permanent (>25 years)		Highly Likely	Irreversible	High	Very High
Operation	Presence of the road	R8-Bat	Very High	Operation- Bats	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration	Baseline. Multiple new stream crossings and stream loss of corridors likely to be utilised by bats for commuting and foraging. Bats are highly likely to be disturbed by the presence of the road.	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Moderate
Construction	Noise/lighting/vibration/ dust	R8-Bat	Very High	Construction- Bats	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.)	Likely Future Ecological Environment. NoR is located in Future Urban Zone, and Special , however it is anticpated that the permanent streams and terrestrial vegetation west of the stream will remain, therefore the bat corridor will be retained. As the surrounding area is Future Urban Zone, it is likely that bats would be disturbed by construction activities (as opposed to highly likely).	Indirect	Local	Short-term (<5 years)	Frequently	Likely	Totally	Low	Moderate
Operation	Presence of the road	R8-Bat	Very High	Operation- Bats	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	Likely Future Ecological Environment. NoR is located in Future Urban Zone, however it is anticpated that the permanent streams and terrestrial vegetation west of the stream will remain, therefore the bat corridor will be retained. Although the stream crossings/stream loss will be less than Baseline, the permanent stream will remain intact, therefore loss in connectivity is still anticipated to occur due to new stream crossings/stream loss.	Indirect	Regional	Permanent (>25 years)		Likely	Irreversible	Moderate	High
Operation	Presence of the road	R8-Bat	Very High	Operation- Bats	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration	Likely Future Ecological Environment. NoR is located in Future Urban Zone, however it is anticpated that the permanent streams and terrestrial vegetation west of the stream will remain, therefore the bat corridor will be retained. As the surrounding area is Future Urban Zone, it is likely that bats would be disturbed by the presence of the road (as opposed to highly likely).	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Moderate
Construction	Noise/lighting/vibration/ dust	R8 - Non-TAR bird	Low	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. As the NoR is a new road that will be intersecting high quality habitat (WW8-W1) for non-TAR species, it is highly likely that disturbance will occur that will result in changes to the population dynamics.	Indirect	Local	Short-term (<5 years)	Frequently	Highly Likely	Totally	Low	Very Low
Operation	Presence of the road	R8 - Non-TAR bird	Low	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. The NoR is a new road that will be intersecting high quality habitat (WW8-W1) for non-TAR species, however there is some existing fragmentation to the west of the NoR (industry and the new motorway), therefore it is likely that loss in connectivity resulting in changes to the population dynamics will occur (particularly for species will a small home range).	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Very Low
Operation	Presence of the road	R8 - Non-TAR bird	Low	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. As the NoR is a new road that will be intersecting high quality habitat (WW8-W1) for non-TAR species, it is highly likely that disturbance will occur that will result in changes to the population dynamics.	Indirect	Local	Permanent (>25 years)	Frequently	Highly Likely	Irreversible	Moderate	Low
Construction	Noise/lighting/vibration/ dust	R8 - Non-TAR bird	Low	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. It is anticipated that birds present will be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R8 - Non-TAR bird	Low	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. It is anticipated that the habitat will already be fragmented in this environment. Therefore, the magnitude and level of effect are considered lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low

NoR R8													
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Operation	Presence of the road	R8 - Non-TAR bird	Low	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. It is anticipated that birds present will be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered lower than Baseline.	Indirect	Local	Permanent (>25 years)	Frequently	Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R8 - New Zealand pipit	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. New Zealand pipit have the potential to utilise any open habitat such as Exotic Grassland and Exotic Scrub (EG is present in NoR R7). Note: 'Definite' likelihood assigned, as New Zealand pipit will require specific management during construction to prevent disturbance to nesting birds in the area.	Indirect	Local	Short-term (<5 years)	Frequently	Definite	Totally	Moderate	High
Operation	Presence of the road	R8 - New Zealand pipit	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. New Zealand pipit have the potential to utilise any open habitat such as Exotic Grassland and Exotic Scrub (EG is present in NoR R7). Although a new road will be intersecting pipit habitat and high densities of pipit are expected in the NoR, the current wider landscape has a large extent of pipit habitat available on the eastern side of the NoR. Therefore, it's unlikely that this loss in connectivity would result in changes to the population dynamics.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R8 - New Zealand pipit	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. New Zealand pipit have the potential to utilise any open habitat such as Exotic Grassland and Exotic Scrub (EG is present in NoR R7). Although a new road will be intersecting pipit habitat and high densities of pipit are expected in the NoR, the current wider landscape has a large extent of pipit habitat available. Therefore, it's unlikely that disturbance to pipit from construction activities would result in changes to the population dynamics.	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R8 - New Zealand pipit	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Suitable habitat for New Zealand pipit is not anticipated to be present in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R8 - New Zealand pipit	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Suitable habitat for New Zealand pipit is not anticipated to be present in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R8 - New Zealand pipit	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Suitable habitat for New Zealand pipit is not anticipated to be present in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R8 - North Island kākā	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Kākā are considered a highly mobile species in this area, with seasonal use and high dispersal. Therefore they are unlikely to be disturbed by construction activities.	Indirect	Local	Short-term (<5 years)	Infrequently	Unlikely	Totally	Negligible	Very Low

NoR R8														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Operation	Presence of the road	R8 - North Island kākā	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Potential kākā habitat (VS2, WF7) is expected to remain intact (due to the height of the proposed bridge). Therefore it is unlikely that any loss in connectivity caused by the presence of the bridge would result in changes to the population dynamics.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R8 - North Island kākā	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Kākā are considered a highly mobile species in this area, with seasonal use and high dispersal. Therefore they are unlikely to be disturbed by the presence of the road.	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R8 - North Island kākā	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. It is anticipated that birds present will be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Infrequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R8 - North Island kākā	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. It is anticipated that kākā habitat would already be fragmented in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R8 - North Island kākā	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. It is anticipated that birds present will be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R8 - Long-tailed cuckoo	Very High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Long-tailed cuckoo are considered a highly mobile species in this area, with high dispersal. Therefore they are unlikely to be disturbed by construction activities.	Indirect	Local	Short-term (<5 years)	Infrequently	Unlikely	Totally	Negligible	Low
Operation	Presence of the road	R8 - Long-tailed cuckoo	Very High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Potential long-tailed cuckoo habitat (VS2, WF7) is expected to remain intact (due to the height of the proposed bridge). Therefore it is unlikely that any loss in connectivity caused by the presence of the bridge would result in changes to the population dynamics.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low
Operation	Presence of the road	R8 - Long-tailed cuckoo	Very High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Long-tailed cuckoo are considered a highly mobile species in this area, with high dispersal. In addition, the majority of suitable habitat (VS2, WF7) will remain intact due to the height of the bridge. Therefore they are unlikely to be disturbed by the presence of the road.	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Low
Construction	Noise/lighting/vibration/ dust	R8 - Long-tailed cuckoo	Very High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. It is anticipated that birds present will be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Infrequently	Unlikely	Totally	Negligible	Low

NoR R8														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Operation	Presence of the road	R8 - Long-tailed cuckoo	Very High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. It is anticipated that long-tailed cuckoo habitat would already be fragmented in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low
Operation	Presence of the road	R8 - Long-tailed cuckoo	Very High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. It is anticipated that birds present will be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Low
Construction	Noise/lighting/vibration/ dust	R8 - Spotless crake	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Spotless crake likely utilising large (> 5000 m2) wetlands present in the NoR (WW8-W1 and WW8-W4) for foraging and nesting. As construction activities will take place within these wetlands, it is highly likely that birds will be disturbed. Spotless crake are known to be in the wider area as they have been picked up in nearby acoustic surveys, and have the potential to be nesting in wetlands present in the NoR (M. Baber, personal communication, 27 January 2023). Note: A manual 'Moderate' level of effect has been assigned, as spotless crake will require specific management during construction to prevent disturbance to nesting birds in the area	Indirect	Local	Short-term (<5 years)	Frequently	Highly Likely	Totally	Low	Moderate
Operation	Presence of the road	R8 - Spotless crake	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Spotless crake likely utilising large (> 5000 m2) wetlands present in the NoR (WW8-W1 and WW8-W4) for foraging and nesting. The new road will fragment these wetlands, with limited wetland extent remaining, therefore a loss in connectivity that results in changes to the population dynamics is considered likely.	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Low
Operation	Presence of the road	R8 - Spotless crake	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Spotless crake likely utilising large (> 5000 m2) wetlands present in the NoR (WW8-W1 and WW8-W4) for foraging and nesting. As the NoR is a new road that is located within these wetlands, it is likely that birds will be disturbed. Spotless crake are known to be in the wider area as they have been picked up in nearby acoustic surveys, and have the potential to be nesting in wetlands present in the NoR (M. Baber, personal communication, 27 January 2023). Note: A manual 'Moderate' level of effect has been assigned, as spotless crake will require specific management to prevent disturbance to nesting birds in the area from the presence of the road.	Indirect	Local	Permanent (>25 years)	Frequently	Likely	Irreversible	Low	Moderate
Construction	Noise/lighting/vibration/ dust	R8 - Spotless crake	High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Delineated wetlands will be retained (and habitat quality likely improved) in the Likely Future Ecological Environment. Therefore there is higher potential for spotless crake to be foraging and nesting in this habitat, and could be disturbed by construction activities. Note: A manual 'Moderate' level of effect has been assigned, as spotless crake will require specific management during construction to prevent disturbance to nesting birds in the area.	Indirect	Local	Short-term (<5 years)	Frequently	Highly Likely	Totally	Low	Moderate

NoR R8														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Operation	Presence of the road	R8 - Spotless crake	High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. The new road will fragment these wetlands, with limited wetland extent remaining, therefore a loss in connectivity that results in changes to the population dynamics is considered likely.	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Low
Operation	Presence of the road	R8 - Spotless crake	High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Delineated wetlands will be retained (and habitat quality likely improved) in the Likely Future Ecological Environment. Therefore there is higher potential for spotless crake to be foraging and nesting in this habitat, and could be disturbed by the presence of the road. Note: A manual 'Moderate' level of effect has been assigned, as spotless crake will require specific management to prevent disturbance to nesting birds in the area from the presence of the road.	Indirect	Local	Permanent (>25 years)	Frequently	Likely	Irreversible	Low	Moderate
Construction	Noise/lighting/vibration/ dust	R8 - Australasian bittern	Very High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Australasian bittern likely utilising large (> 5000 m2) wetlands present in the NoR (WW8-W1 and WW8-W4) for foraging. As construction activities will take place within these wetlands, it is highly likely that birds will be disturbed. However, Australasian bittern are considered a highly mobile species in this area, with high dispersal. Additionally, bittern are not expected to nest in this area. Therefore it is unlikely that disturbance from construction activities will result in changes to the population dynamics.	Indirect	Local	Short-term (<5 years)	Infrequently	Unlikely	Totally	Negligible	Low
Operation	Presence of the road	R8 - Australasian bittern	Very High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Australasian bittern likely utilising large (> 5000 m2) wetlands present in the NoR (WW8-W1 and WW8-W4) for foraging. The new road will fragment these wetlands, with limited wetland extent remaining, however, Australasian bittern are considered a highly mobile species in this area, with high dispersal. Therefore a loss in connectivity that results in changes to the population dynamics is considered unlikely.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low
Operation	Presence of the road	R8 - Australasian bittern	Very High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Australasian bittern likely utilising large (> 5000 m2) wetlands present in the NoR (WW8-W1 and WW8-W4) for foraging. The new road will be built within these wetlands, therefore it is highly likely that birds will be disturbed. However, Australasian bittern are considered a highly mobile species in this area, with high dispersal. Additionally, bittern are not expected to nest in this area. Therefore it is unlikely that disturbance from the presence of the road will result in changes to the population dynamics.	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Low
Construction	Noise/lighting/vibration/ dust	R8 - Australasian bittern	Very High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Australasian bittern are considered a mobile species in this area, with high dispersal, and unlikely to be nesting. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Short-term (<5 years)	Infrequently	Unlikely	Totally	Negligible	Low
Operation	Presence of the road	R8 - Australasian bittern	Very High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Although it is anticipated that the delineated wetland will be retained, as Australasian bittern are considered a highly mobile species in this area, with high dispersal, a loss in connectivity that results in changes to the population dynamics is considered unlikely. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low

NoR R8														
Phase	**Project Activity**	**Resource Unit (Habitat/Species)**	**Ecological Value**	**Effect Description Main**	**Effect Description Detailed**	**Effects Description Manual**	**Type**	**Extent (ZOI)**	**Duration**	**Frequency**	**Likelihood**	**Reversibility**	**Magnitude (pre-mitigation)**	**Level of Effect (Pre-mitigation)**
Operation	Presence of the road	R8 - Australasian bittern	Very High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Australasian bittern are considered a mobile species in this area, with high dispersal, and unlikely to be nesting. Therefore, the magnitude and level of effect are considered the same as or lower than Baseline.	Indirect	Local	Permanent (>25 years)	Infrequently	Unlikely	Irreversible	Negligible	Low
Construction	Noise/lighting/vibration/ dust	R8 - Dabchick	Very High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Dabchick likely utilising open water associated with planted wetlands in the NoR (WW8-W1) for foraging and nesting. As construction activities will take place within these wetlands, it is highly likely that birds will be disturbed. In addition, there is limited habitat availiable for dabchick in the wider environment. Therefore it is likely that this disturbance will result in changes to the population dynamics.	Indirect	Local	Short-term (<5 years)	Frequently	Likely	Totally	Low	Moderate
Operation	Presence of the road	R8 - Dabchick	Very High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Dabchick likely utilising open water associated with planted wetlands in the NoR (WW8-W1). The NoR will fragment these wetlands, with limited wetland extent remaining. In addition there is limited suitable habitat for dabchick in the wider landscape. Only western portion of wetland will remain during operation therefore fragmentation is unlikely Therefore a loss in connectivity that results in changes to the population dynamics is considered likely.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low
Operation	Presence of the road	R8 - Dabchick	Very High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Dabchick likely utilising open water associated with planted wetlands in the NoR (WW8-W1) for foraging and nesting. Western portion of WW8-W1 will remain and likley to be used by Dabchick As the NoR will fragment suitable habitat in the NoR (WW8-W1), it is unlikely that dabchick would utilise this wetland during operation of the road (due to the lowered quality of habitat).	Indirect	Local	Permanent (>25 years)	Frequently	Likely	Irreversible	Low	Moderate
Construction	Noise/lighting/vibration/ dust	R8 - Dabchick	Very High	Construction- Birds	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Delineated wetlands will be retained (and habitat quality likely improved) in the Likely Future Ecological Environment. Therefore there is potential for dabchick to be foraging and nesting in this habitat, and could be disturbed by construction activities. Therefore, the magnitude and level of effect are considered the same as Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Likely	Totally	Low	Moderate
Operation	Presence of the road	R8 - Dabchick	Very High	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Delineated wetlands will be retained (and habitat quality likely improved) in the Likely Future Ecological Environment. Therefore there is potential for dabchick to be foraging and nesting in this habitat, and could be disturbed by construction activities. Only western portion of wetland will remain during operation therefore fragmentation is unlikely The NoR will fragment these wetlands, with limited wetland extent remaining. In addition there is limited suitable habitat for dabchick in the wider landscape. Therefore, the magnitude and level of effect are considered the same as Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Low

NoR R8														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Operation	Presence of the road	R8 - Dabchick	Very High	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Dabchick likely utilising open water associated with western portion of planted wetlands in the NoR (WW8-W1) for foraging and nesting. As the NoR will fragment suitable habitat in the NoR (WW8-W1), it is unlikely that dabchick would utilise this wetland during operation of the road (due to the lowered quality of habitat). Therefore, the magnitude and level of effect are considered the same as Baseline.	Indirect	Local	Permanent (>25 years)	Frequently	Likely	Irreversible	Low	Moderate
Construction	Noise/lighting/vibration/ dust	R8 - Copper skink	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. As the NoR is a new road that intersects potential copper skink habitat, and due to their small home range, it is likely that copper skink will be disturbed by construction activities.	Indirect	Local	Short-term (<5 years)	Frequently	Likely	Totally	Low	Low
Operation	Presence of the road	R8 - Copper skink	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. As the NoR is a new road that intersects potential copper skink habitat, and due to their small home range, it is likely that loss in connectivity will occur.	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Low
Operation	Presence of the road	R8 - Copper skink	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Baseline. As the NoR is a new road that intersects potential copper skink habitat, and due to their small range, it is likely that copper skink will be disturbed by the presence of the road.	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Low
Construction	Noise/lighting/vibration/ dust	R8 - Copper skink	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Suitable habitat for copper skink is not anticipated to be present (or very limited/low quality) in this environment. Therefore, the magnitude and level of effect are considered lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R8 - Copper skink	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Suitable habitat for copper skink is not anticipated to be present (or very limited/low quality) in this environment. Therefore, the magnitude and level of effect are considered lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R8 - Copper skink	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Suitable habitat for copper skink is not anticipated to be present (or very limited/low quality) in this environment. Therefore, the magnitude and level of effect are considered lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R8 - Ornate skink	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. As the NoR is a new road that intersects potential ornate skink habitat, and due to their small home range, it is likely that ornate skink will be disturbed by construction activities.	Indirect	Local	Short-term (<5 years)	Frequently	Likely	Totally	Low	Low
Operation	Presence of the road	R8 - Ornate skink	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. As the NoR is a new road that intersects potential ornate skink habitat, and due to their small home range, it is likely that loss in connectivity will occur.	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Low
Operation	Presence of the road	R8 - Ornate skink	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Baseline. As the NoR is a new road that intersects potential ornate skink habitat, and due to their small range, it is likely that ornate skink will be disturbed by the presence of the road.	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Low
Construction	Noise/lighting/vibration/ dust	R8 - Ornate skink	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Suitable habitat for ornate skink is not anticipated to be present (or very limited/low quality) in this environment. Therefore, the magnitude and level of effect are considered lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low

NoR R8														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Operation	Presence of the road	R8 - Ornate skink	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Suitable habitat for ornate skink is not anticipated to be present (or very limited/low quality) in this environment. Therefore, the magnitude and level of effect are considered lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R8 - Ornate skink	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Suitable habitat for ornate skink is not anticipated to be present (or very limited/low quality) in this environment. Therefore, the magnitude and level of effect are considered lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Construction	Noise/lighting/vibration/ dust	R8 - Elegant gecko and forest gecko	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Arboreal gecko species are potentially utilising the stands of native terrestrial vegetation (VS2, WF7) that are present within the NoR. Construction activities will take place within these areas for the proposed bridge construction. As they are nocturnal species, and as the NoR is a new road, it is highly likely that they are highly sensitive to construction disturbance, particularly construction lighting at night.	Indirect	Local	Short-term (<5 years)	Frequently	Highly Likely	Totally	Low	Low
Operation	Presence of the road	R8 - Elegant gecko and forest gecko	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Although data is limited on the home range of geckos, it is expected that some connectivity is retained as the gecko habitat will be bridged. Therefore it is unlikely that this loss in connectivity will result in changes to the population dynamics.	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Low
Operation	Presence of the road	R8 - Elegant gecko and forest gecko	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Baseline. Arboreal gecko species are potentially utilising the stands of native terrestrial vegetation (VS2, WF7) that are present within the NoR. The NoR is a new road with a proposed bridge that will be built over these areas. As they are nocturnal species, and as the NoR is a new road, it is highly likely that they are highly sensitive to disturbance from the presence of the road (particularly lighting at night).	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Low
Construction	Noise/lighting/vibration/ dust	R8 - Elegant gecko and forest gecko	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Although it is anticipated that most of the gecko habitat will be retained in the permanent stream buffer of WW8-S3, it is expected that gecko will already be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R8 - Elegant gecko and forest gecko	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. It is anticipated that most of the gecko habitat will be retained in the permanent stream buffer of WW8-S3. Although data is limited on the home range of geckos, it is expected that some connectivity is retained as the gecko habitat will be bridged. Therefore it is unlikely that this loss in connectivity will result in changes to the population dynamics.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R8 - Elegant gecko and forest gecko	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Although it is anticipated that most of the gecko habitat will be retained in the permanent stream buffer of WW8-S3, it is expected that gecko will already be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low

NoR R8														
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed	Effects Description Manual	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (Pre-mitigation)
Construction	Noise/lighting/vibration/ dust	R8 - Pacific gecko	Moderate	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Baseline. Arboreal gecko species are potentially utilising the stands of native terrestrial vegetation (VS2, WF7) that are present within the NoR. Construction activities will take place within these areas for the proposed bridge construction. As they are nocturnal species, and as the NoR is a new road, it is highly likely that they are highly sensitive to construction disturbance, particularly construction lighting at night.	Indirect	Local	Short-term (<5 years)	Frequently	Highly Likely	Totally	Low	Low
Operation	Presence of the road	R8 - Pacific gecko	Moderate	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Baseline. Although data is limited on the home range of geckos, it is expected that some connectivity is retained as the gecko habitat will be bridged. Therefore it is unlikely that this loss in connectivity will result in changes to the population dynamics.	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Low
Operation	Presence of the road	R8 - Pacific gecko	Moderate	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Baseline. Arboreal gecko species are potentially utilising the stands of native terrestrial vegetation (VS2, WF7) that are present within the NoR. The NoR is a new road with a proposed bridge that will be built over these areas. As they are nocturnal species, and as the NoR is a new road, it is highly likely that they are highly sensitive to disturbance from the presence of the road (particularly lighting at night).	Indirect	Local	Permanent (>25 years)		Likely	Irreversible	Low	Low
Construction	Noise/lighting/vibration/ dust	R8 - Pacific gecko	Moderate	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust, vibration etc) resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Although it is anticipated that most of the gecko habitat will be retained in the permanent stream buffer of WW8-S3, it is expected that gecko will already be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered lower than Baseline.	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	R8 - Pacific gecko	Moderate	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland, and riparian habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. It is anticipated that most of the gecko habitat will be retained in the permanent stream buffer of WW8-S3. Although data is limited on the home range of geckos, it is expected that some connectivity is retained as the gecko habitat will be bridged. Therefore it is unlikely that this loss in connectivity will result in changes to the population dynamics.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low
Operation	Presence of the road	R8 - Pacific gecko	Moderate	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use, resulting in changes to the population dynamics	Likely Future Ecological Environment. NoR is located in Future Urban Zone. Although it is anticipated that most of the gecko habitat will be retained in the permanent stream buffer of WW8-S3, it is expected that gecko will already be habituated to disturbance in this environment. Therefore, the magnitude and level of effect are considered lower than Baseline.	Indirect	Local	Permanent (>25 years)		Unlikely	Irreversible	Negligible	Very Low

10 Appendix 10 – Rapid Habitat Assessment Results

Table 18-34 Summary of RHA values

Stream ID	Deposited Sediment	Invertebrate habitat diversity	Invertebrate habitat abundance	Fish cover diversity	Fish cover abundance	Hydraulic heterogeneity	Bank erosion	Bank vegetation	Riparian width	Riparian shade	RHA Habitat Quality Score	Corresponding Habitat Value*
WW1-S1	-	-	-	-	-	-	-	-	-	-	N/A	N/A
WW1-S2	-	-	-	-	-	-	-	-	-	-	N/A	N/A
WW2-S1	7	8	10	9	10	6	7.5	7	8	8	80.5	G
WW2-S2	1	6	2	6	7	5	7	6	4	6	50	M
WW2-S3	1	9	4	9	8	4	6	7	8	8	64	G
WW2-S4	1	4	2	5	5	1	1	3	7	9	38	P
WW3-S1a	1	4	6	5	6	5	6.5	4	2.5	5	45	M
WW3-S1b	1	5	2	6	7	5	7	4	6	5	48	M
WW3-S1c	1	4	1	4	7	1	7	4	5.5	7	41.5	M
WW3-S2a	1	3	3	4	7	4	1	5	1	8	37	P
WW3-S2b	1	3	3	4	7	4	1	5	1	8	37	P
WW3-S3a	3	3	1.5	4	3	2	1	2	1.5	4	25	P
WW3-S3b	1	4	1	7	4	1	2	3	2	4	29	P
WW3-S4a	1	4	2	6	7	3	7	4	6	8	48	M
WW3-S4b	1	4	1	8	7	1	3	3	5	7	40	P
WW4-S1	1	1	1	1	1	1	1	2	5.5	3	17.5	P
WW4-S2	1	1	1	1	1	1	3	2	6	3	20	P
WW4-S3	1	1	1	1	1	1	3	2	4.5	3	18.5	P
WW5-S1	9	10	9	9	7	8	8	7	8	8	83	E
WW5-S2	3	8	3	8	6	5	5	5	8.5	9	60.5	M
WW5-S3	1	2	1	2	2	1	3	2	9	8	31	P

Stream ID	Deposited Sediment	Invertebrate habitat diversity	Invertebrate habitat abundance	Fish cover diversity	Fish cover abundance	Hydraulic heterogeneity	Bank erosion	Bank vegetation	Riparian width	Riparian shade	RHA Habitat Quality Score	Corresponding Habitat Value*
WW5-S4	1	3	1	4	4	2	1	2	2	6	26	P
WW5-S5	1	4	1	2	3	2	1	3	2	8	27	P
WW5-S6	3	4	5	4	2	3	2	3	10	9	45	M
WW6-S1	1	3	3	3	4	3	3	6	7	7	40	P
WW6-S2	1	2	1	3	6	3	4	7	9	9	45	M
WW7-S1^	1	4	1	4	3	1	2	3	10	7	36	P
WW7-S2a	1	5	2	5	2	5	7.5	6	3	9	45.5	M
WW7-S2b	1	1	1.5	2	2	2	1	6	1	8	25.5	P
WW7-S3a	1	3	1	5	5	3	6	5	5.5	7	41.5	M
WW7-S3b	1	2	1	3	2	1	1	7	6	7	31	P
WW7-S4	7	9	8	9	9	10	7	5	7.5	9	80.5	G
WW7-S5	1	2	1	2	2	1	8	3	4.5	8	32.5	P
WW7-S6a	2	4	1	5	4	2	2	2	2	8	32	P
WW7-S6b	1	2	1	2	2	1	6	3	5.5	8	31.5	P
WW8-S1	1	4	1	6	6	2	5	6	6.5	8	45.5	M
WW8-S2	4	6	4	6	5	5	6	4	10	7	57	M
WW8-S3	-	-	-	-	-	-	-	-	-	-	N/A	N/A

Notes:

NA = Stream assessed at desktop level due to access restrictions.

* = Corresponding habitat values for each habitat quality score

P = Poor (Score 10-40)

M = Moderate (Score 41-60)

G = Good (Score 61-80)

E = Excellent (Score 81+)

Light blue shading = Permanent stream

No shading = Intermittent stream

11 Appendix 11 – Significant Ecological Areas

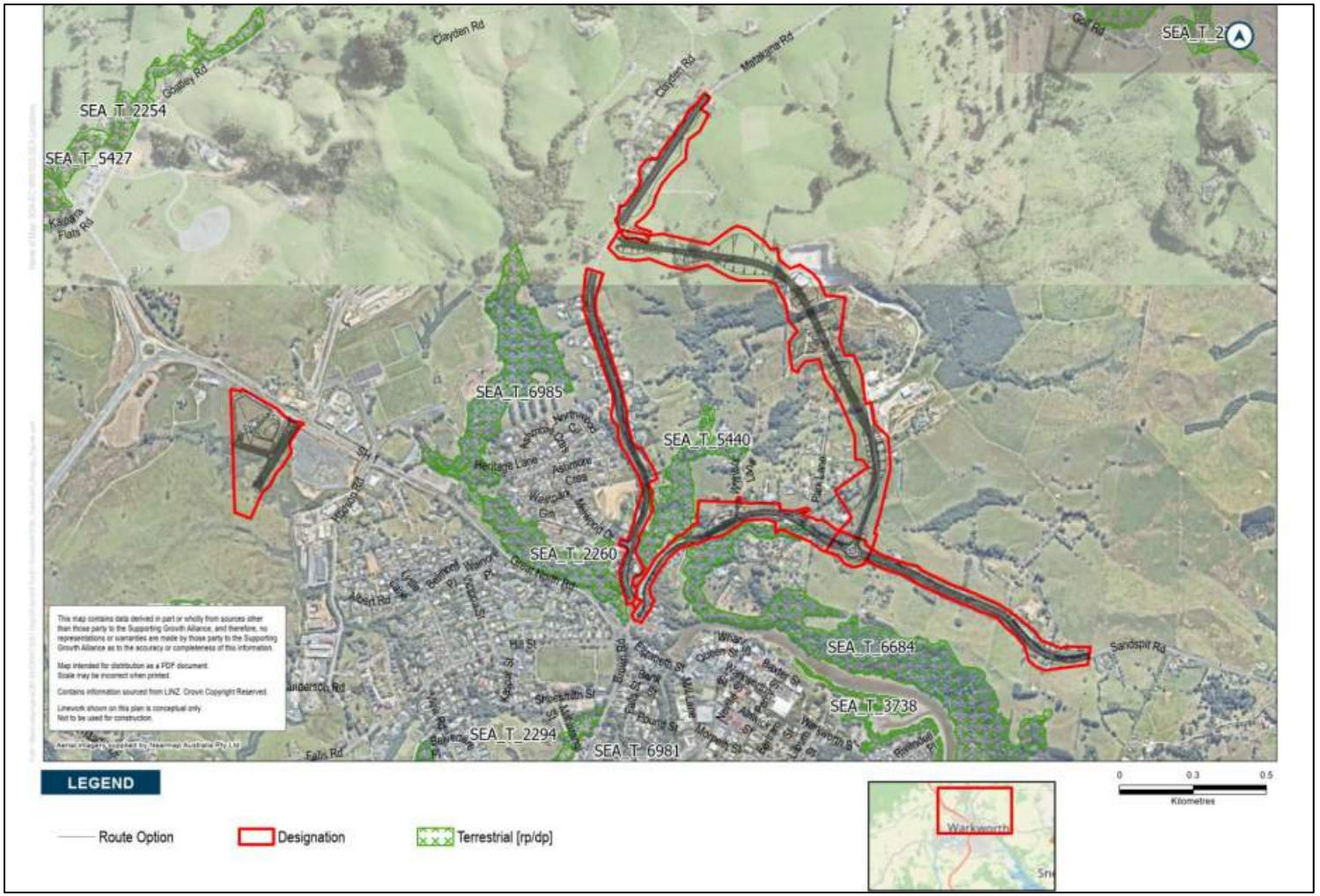


Figure 18-1 Significant Ecological Areas (SEAs) (northern area)

Figure 18-2 Significant Ecological Areas (SEAs) (southern area)

12 Appendix 12 – Indicative Mitigation Areas

LEGEND

Route Option

Designation

Indicative Bat Mitigation

0 0.3 0.5
Kilometres

LEGEND

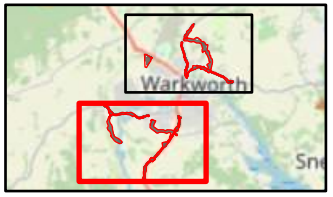
Route Option

Designation

Indicative Bat Mitigation

0 0.3 0.5

Kilometres



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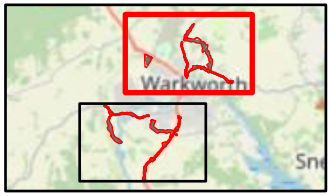
Name of Map: SGA-EC-WW-040-Bird-Mitigation

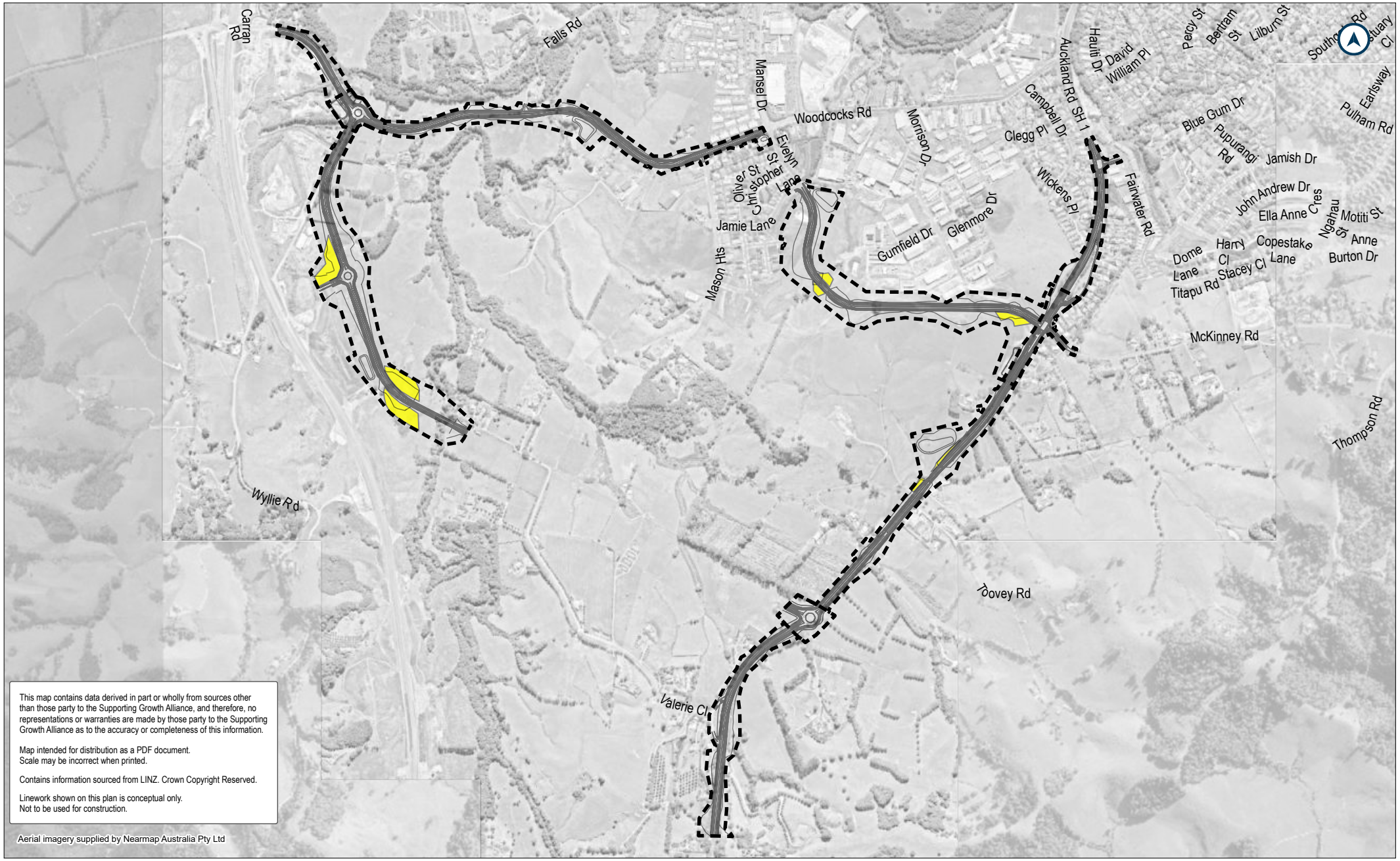
Path: \\Beca.net\projects\381\38109\34\TG\01 Maps\06 ArcGIS Pro\01 Warkworth\SGA_Warkworth_Ecology_Figures.aprx

LEGEND

- Route Option
- Designation
- Indicative Bird Mitigation

0 0.3 0.5
Kilometres





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Path: \\Beca.net\projects\38\138109\94\TG\01 Map\06 ArcGIS Pro\01 Warkworth\SGA_Warkworth_Ecology_Figures.aprx

LEGEND

- Route Option
- Designation
- Indicative Bird Mitigation

0 0.3 0.5
Kilometres

13 Appendix 13 – Biodiversity Compensation Model (BCM) for potential SEA loss

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Model Inputs		
Input descriptors	Input data	
Project/reference name	SGA Warkworth	
Biodiversity type	T	
Technical expert(s) input	Michiel Jonker	
Benchmark	5	
How many habitat types OR sites are impacted	2	
Number of proposed compensation actions	1	
Net gain target	10%	
Habitat/Site Impact(s)	WF11	TL3
Impact risk contingency:	3	2
Impact uncertainty contingency:	3	2
Areal extent of impact (ha):	0.1147	0.1287
Value score prior to impact:	4	3
Value score after impact:	0.01	0.01
Compensation Action(s)	Compensation Action 1	
Discount rate:	3.0%	
Finite end point (years):	50	
Compensation confidence contingency:	3	
Areal extent (ha) of compensation type:	2.04	
Value score prior to compensation:	0.01	
Value score after compensation:	4	

Model outputs			
	Total impact score	WF11	TL3
Impact score	-0.20971	-0.12082	-0.08889
	Total compensation score	Compensation Action 1	
Compensation score	0.23209	0.23209	
Net gain outcome	10.7%		

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M. Baber, J. Dickson, J. Quinn, J. Markham, G. Ussher, S. Jackson and S. Heggie-Gracie

Figure 18-3 Biodiversity Compensation Model inputs and outputs for NOR 2 - Woodcocks Road Upgrade

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Model Inputs	
Input descriptors	**Input data**
Project/reference name	SGA Warkworth
Biodiversity type	TL3
Technical expert(s) input	Michiel Jonker
Benchmark	5
How many habitat types OR sites are impacted	1
Number of proposed compensation actions	1
Net gain target	10%
Habitat/Site Impact(s)	**WF7.1**
Impact risk contingency:	2
Impact uncertainty contingency:	2
Areal extent of impact (ha):	0.0774
Value score prior to impact:	3
Value score after impact:	0.01
Compensation Action(s)	**Compensation Action 1**
Discount rate:	3.0%
Finite end point (years):	50
Compensation confidence contingency:	2
Areal extent (ha) of compensation type:	0.4
Value score prior to compensation:	0.01
Value score after compensation:	4

Model outputs		
	Total impact score	**WF7.1**
Impact score	**-0.05346**	-0.05346
	Total compensation score	**Compensation Action 1**
Compensation score	**0.06007**	0.06007
Net gain outcome	**12.4%**	

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Figure 18-4 Biodiversity Compensation Model inputs and outputs for NOR 4 - Matakana Road Upgrade

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Model Inputs			
Input descriptors	Input data		
Project/reference name	SGA Warkworth		
Biodiversity type	WF7.1		
Technical expert(s) input	Michiel Jonker		
Benchmark	5		
How many habitat types OR sites are impacted	3		
Number of proposed compensation actions	1		
Net gain target	10%		
Habitat/Site Impact(s)	WF7.1	MF4	EF
Impact risk contingency:	3	3	2
Impact uncertainty contingency:	3	3	2
Areal extent of impact (ha):	0.1264	0.0579	0.1934
Value score prior to impact:	5	4	3
Value score after impact:	0.01	0.01	0.01
Compensation Action(s)	Compensation Action 1		
Discount rate:	3.0%		
Finite end point (years):	50		
Compensation confidence contingency:	3		
Areal extent (ha) of compensation type:	3.5		
Value score prior to compensation:	0.01		
Value score after compensation:	4		

Model outputs				
	Total impact score	WF7.1	MF4	EF
Impact score	-0.36108	-0.16651	-0.06099	-0.13358
	Total compensation score	Compensation Action 1		
Compensation score	0.39819	0.39819		
Net gain outcome	10.3%			

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Figure 18-5 Biodiversity Compensation Model inputs and outputs for NOR 4 - Sandspit Road Upgrade